ENGINEER
YEAR

ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

NOVEMBER 6, 1948

Pulse Radar Principle Locates Line Faults Quickly

In This Issue

ystem Load Allocation

•

Locating Line Faults

•

ogenerator Design Today

NEW all-metal WESTON

MAGNETIC CONTACT *easily set to make contact at any point on scale*

This new Weston combines the features of an indicating device with the advantages of an alarm or control instrument. A contact arm, mounted as shown above, is easily set to make contact at any temperature on the scale.

A terminal block on the periphery of the case makes electrical connection easy. The thermometer is all-metal, typically WESTON in ruggedness and reliability, with accuracy of ±1% as an indicating thermometer, and ±1½% as a contact making device. It is supplied in two types—for operation on either increasing or decreasing temperatures.

For complete information see your local WESTON representative or write Weston Electrical Instrument Corporation, 617 Frelinghuysen Avenue, Newark 5, New Jersey.

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Industrial Thermometers | MAX-MIN Thermometers | Contact-making Thermometers

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ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; James H McGraw, Jr, President; Curtis W McGraw, Vice-President and Treasurer; Eugene Duffield, Executive Assistant for Publications; Nelson Bond, Director of Advertising; Joseph A Gerardi, Secretary; J E Blackburn, Jr, Director of Circulation. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Copyright 1948, by McGraw-Hill Publishing Company, Inc. All Rights Reserved. Cable address McGRAW-HILL, New York. Member ABP Member ABC

ELECTRICAL WORLD

Published for 74 years for those engaged in the business of generating transmitting, distributing or applying electric power

November 6, 1948 **CONTENTS** Vol. 130 No.19

This Week's Cover Picture

Sustained faults on transmission lines of Puget Sound Power & Light Co are located by sending d-c pulses along the line and measuring time for reflection. Capacitors and gaps, in foreground, isolate the instrument and protect personnel. See page 88. A related technique, used by New Orleans Public Service Inc, is discussed on page 92. Cover photo by J. A. Robinson, Pacific Coast Editor, ELECTRICAL WORLD

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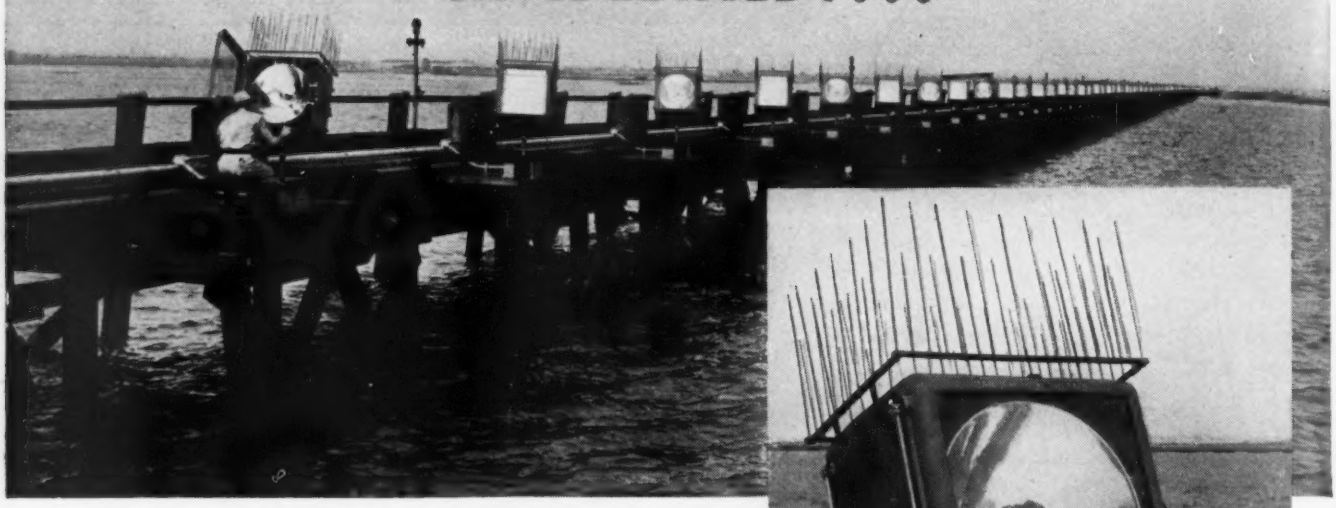
GREATER SAFETY AND FLIGHT REGULARITY AT IDLEWILD....



....with 3 Billion Candle Power "ALL WEATHER GUIDE LIGHTS" powered through HAZARD'S KEYSTONE-HAZAPRENE CABLE

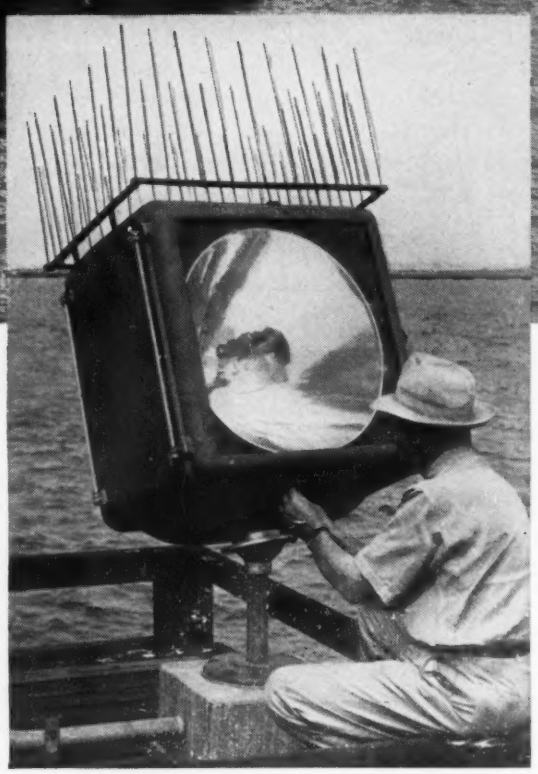
Of the many important electrical advances made in airport lighting, power transmission and flight control at the New York International Airport, one of the most interesting is the "All Weather Guide Lights."

Designed to provide pilots with reliable visual guidance in adverse flying conditions, these high intensity approach and contact lights consist of 35 Blaze Units, 35 Flash Units — all controllable from the operational tower.

One of the insulated wire and cable requirements at Idlewild served by Hazard is the power supply to these vital lighting aids, and here Keystone-Hazaprene Cable is used.

For high voltage circuits, Hazard's Keystone insulation effectively combines in one oil base compound unusual resistance to ozone, heat, moisture, sunlight, chemicals and acids. Protected with a Hazaprene sheath (a Hazard-developed neoprene compound) — Keystone-Hazaprene Cable assures the long-lived, trouble-free service required from these lighting circuits.

In planning electrical wire and cable needs for modern airports, you'll find Hazard's engineering experience, outstanding insulations, and protective coverings will help you obtain the right answer to your particular operating conditions. For example, over twenty years field service under severe operating conditions has proved Hazasheath and Armortite Cable ideal for trouble-free, long-lived power transmission, communication and control circuits. Non-metallic sheathed, these cables are light-weight, quick and easy to install . . . are buried direct or run in conduits. Whatever your need, you can rely on Hazard Insulated Wires and Cables for long, continuous, safe, trouble-free service. Our engineering service is available without obligation. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.



High Intensity, Controllable, All Weather Guide Lights at New York International Airport, Idlewild, N. Y., installed by Hoffman and Elias. Flash and Blaze units alternate, with the Flash Units capable of developing 3 billion candlepower to assure pilots of visual contact with field through poorest weather conditions. Wire "feelers" on top of each light discourage seagulls from landing.

KEYSTONE-HAZAPRENE

ARMORTITE

HAZASHEATH

HAZARD

6883

insulated wires and cables for every electrical use

First—We Need Unity

EDISON ELECTRIC INSTITUTE'S policy committee on the public information program met recently and enlarged its membership from nine to thirty-one. And it agreed that no such venture should proceed very far without a statement of principles to which all participants could agree and contribute loyal support. The reaction to this first step of the committee has been varied.

Some saw the expansion from nine to thirty-one members as an attempt to ensnarl the entire program in such a morass of conflicting opinion as to throttle it. Others saw it as an attempt to win the broad national support such a venture should and must have. Apparently, either of these reactions could be correct but we trust the latter interpretation is more accurate.

What seems significant is that there could be such a reaction as the first. It gives further evidence of disunity among the agencies which must unify to put over any such program. And certainly disunity is pleasing to those who oppose this industry. We can't guess what could possibly make them happier.

The power business should be forcefully reminded of two simple facts. First, that the matter of changing public opinion from one point to another point on a given issue is something which is done every day. It's a commodity which you can buy in the market place. It may be harder or easier, depending on a lot of things, and there are probably a number of issues on which it couldn't be done effectively within the foreseeable future. But by and large, if you have the money, the will and the case, you can move John Public's opinion from here to there on a given question. It's been done in the past and it will be done again. The power business can buy some for itself, provided . . .

The second fact this industry should recognize is that all the money and brains in the world can't buy such a remolding of public opinion without the will and the case. You can't successfully sell the public if you haven't got something to sell it. Either private ownership of power has a case or it hasn't. We know that it has; so we aren't concerned with either the money or the case. But we certainly are troubled about whether the industry has the will.

The will to do the job is the one thing which this industry as a whole hasn't shown, and it's something which can't be bought. Not even if the industry were united under common ownership of one holding company—heaven forbid—could the will be bought or commanded. So long as a system which is remote from federal competition has greater fear of a local politician than it has of the death of a distant operating company, the best brains in the opinion trade aren't going to sell the power business. Indeed, if they know the facts, they will not try.

Before this industry needs any kind of a program—at any level—it needs unity. It needs to earnestly care about the power business as a whole and not merely as a collection of shareholders' groups. When its members care about what happens to somebody elses's stockholders, it will examine the public information program and make the right decision. Until then, it can't.

Loosen the Brake On Lighting

TODAY the strongest brake on progress in the lighting art is memory. Not the conscious memory of the individual mind recalling its own perceptions, but the instinctive memory common to all minds that stems back to the time when Prometheus brought fire down from Olympus to the earth.

The memory is that artificial light must come from an apparent source. We move about through the day without any especial perception of the sun as its source of light. But when night comes we are definitely conscious of the lamp whose light pushes the darkness back. That consciousness of the lamp has its origin in mankind's memory of the fire on the floor of the cave, of the torch stuck in the niche of the wall, and of all the succeeding forms of light provision by means of flame. Up to our day of electricity all artificial light came from combustion and all sources of it had one thing in common. They had to be attended. Requiring attention, they had to be easily accessible. Consciousness of the lamp became a natural concomitant of the provision of artificial light. And, naturally, our way of thinking on most lighting applications is primarily of light sources and secondarily of light itself. That's the brake on progress.

It would be a good idea for practitioners in the lighting art to look closely at the first chapter of Genesis in the Bible. They will discover something that goes counter to their habit of thought. "The Lord said, 'Let there be light,' and there was light." That was the first day of creation. It was not until the fourth day that the Lord set the sun and the moon and the stars in the sky.

Until our time the lamp, the visible source of light, was necessarily a central consideration in artificial lighting. Modern ways of light production have removed that necessity. No longer need we think of lighting, exclusively in terms of lamps. Where it is desirable we can banish the lamp and keep its light.

The People's Choice

WE SEE BY THE PAPERS that delegates to the recent Northwest Public Power Association have been warned of impending assaults on public power in the next session of Congress. That makes the fourth consecutive Congress, at least, about which such dire tidings have been spread. If the 81st Congress equals its immediate predecessors in this regard, public power will be feeling small pain.

Rep Henry M. Jackson, Washington Democrat, warned NPPA that the danger would come in the form of appropriations bill riders which might ban funds for the Bonneville Power Administration if it sells energy to a Public Utility District which acquired private utility properties without a vote of the people. And so they should.

There's been a lot of argument about the length of time after a condemnation vote during which a mandate to acquire private power facilities should be regarded as valid. Extremists have argued that a single vote condemning a property should always be valid, even if no action is taken toward acquisition for years after the vote. Others have argued, conversely, that a single vote for condemnation should be ratified by several subsequent votes, before any action to acquire should be undertaken.

We believe no utility property should be transferred from public to private ownership without an opportunity for a serious vote on the matter by those whose utility service will be affected by the change. If there's any prospect that such elections will be denied the Northwest's electric customers, then some such riders as those to which Jackson called attention are warranted.

Give Young Spirits a Chance

SOMEBODY is going to be obligated to do something really worth while about this matter of low rates and high costs. The rate experts, the financiers, the load-builders, will all do what they can but, as sure as fate, the brunt will fall on the engineers. They are responsible for the wise use of the ten billions being spent for expansion.

The situation is so acute that whatever is done will have to take on the semblance of revolution—hardly anything less will suffice if the pinch is not eased otherwise. The key words are simplification and/or complication. In many instances the answer *is* addition of complicating mechanisms.

But for the bulk of the cost problems, the answer is in the other direction—direct simplification. The spirit should be more of that which originated the outdoor power plant, the unit station and substation, the socket meter. For example, does the basement of the typical power plant *have* to have so many gadgets to squeeze out a few more Btu? The refinements grew by progressive improvement in efficiency, but do they all justify their cost under today's conditions? Makers and users alike might have great difficulty in trying to prove the value of everything but the indispensable, boiler, feed pump, turbine and condenser.

Could one eliminate a whole floor in the plant by just using the condenser frame as the island for the turbine? Is it practicable to design all substations for mobility? How about just screwing a pole into the ground as is done with anchors? All the wires on the poles might be arranged vertically (Western Union instituted the crossarm in the middle of the 19th century).

Few of the well-established supervisory engineers who read this will see even a glimmer of sense in any of these radically crazy suggestions. They know much too well that some things just cannot be done. But the industry has many young spirits untrammeled by habituation and the super-restraints of caution. Some of them are fortunately unaware that certain things cannot be done. Their unfettered courage could easily overshadow the impossibilities and achieve some revolutionary innovations in designs and practices. Better give those young spirits a chance at the task.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

A survey by the Public Utilities Advertising Association has revealed for the first time just how much electric and gas utilities are spending for advertising and, what is more important, how they are spending each dollar . . . End of the basing point system for silicon sheet steel has brought serious repercussions to the electrical industry. Both prices and production have been affected, and the final result will be fewer and more expensive power transformers . . . Technical committees of the PEA have been warned that they are expected to give positive help in getting every bit of energy they can out of present capacity during the present shortage . . . The U. S. Chamber of Commerce has fired its opening blast in its fight on TVA's plan to build a steam plant . . . Three utilities have asked industrial and commercial customers to curtail energy use during peak periods . . . And a survey by ELECTRICAL WORLD shows that utilities have been building inventories at a rapid pace which seems to have steadied since last July.

Federal Power Commission split decisions are getting more numerous—and more explosive. By a recent 3-2 verdict, the Commission rejected Tennessee Gas Transmission Co's application to build new facilities. Two weeks later, Commissioner Olds produced a "concurring statement" repudiating the dissenting opinion of Commissioners Smith and Wimberly.

NSRB sources believe some allocations of raw materials and industrial equipment will be necessary next year. Such controls would help meet prospective expanding demands for national defense, stepped-up foreign aid, possibly military lend-lease to anti-Communist nations. Steel, aluminum, other components of electrical equipment would be affected, it is believed.

Opponents of the New York-Ontario proposal to develop St. Lawrence hydro power are trying to arouse steel industry support. They point to recently discovered iron deposits in Labrador, claim the Seaway is needed to bring this ore to the Great Lakes area. If the river's power is developed, they add, the navigation improvements may be forgotten.

The British are adding two 52,000-kw units to their Kearsley station, near Manchester, which will generate at 33 kv. This marks a continuation of the English trend to such a generating voltage. In this country, machines are edging slowly upward from the 11 and 13-kv levels to alleviate the problem of generator-load amperes.

One costly item in building power plants is often forgotten—the interest on the construction funds until the plant goes on the line and starts earning its way.

To help ease its shortage of steel scrap, the United States Steel Corp has started to import scrap from Germany.

Kennecott Copper Co with its mine at Bingham, Utah, and U. S. Steel with its Geneva Plant near Provo, Utah, are helping relieve the Northwest power shortage. From their power plants at these places they are feeding excess power nightly into the Utah Power & Light System, which passes it on to the Northwest Power Pool over the lines of Idaho Power, Montana Power, and Washington Water Power.

Discount rumors you have been hearing about "sure-fire" recommendations by the Hoover Commission. Task forces of the Commission are just completing reports on power agencies. These reports will have influence, but they may not coincide with recommendations of the Commission itself next January.

If it is any encouragement for the electric utility industry, the gas utility industry will need 3.3 billion dollars in the five-year period, 1948-52.

Notes From The News:

Of the $14,467,000 income from Shasta Dam power between July, 1945, and September, 1948, $14,447,000 came from the Pacific Gas & Electric Co. The average charge for the 5,430,000,000 kwhr sold was 2.66 mills . . . Electric utilities are burning more bituminous coal than ever. Consumption for September was 8,616,062 tons, 8.7% more than in September, 1947, and the highest September use of record . . . Demand

for aluminum is running 500,000,000 lb ahead of 1948 production, according to Donald M. White, secretary of the Aluminum Association . . . One of the least exclusive clubs in Niagara Falls, Ont., is the Saturday Wash Club. Its purpose is to encourage housewives to wash their clothes on Saturdays when industries are idle in order to conserve power.

Tucson Gas, Electric Light & Power Co is installing two-way radio on 12 of its automobiles and trucks . . . The domestic price of zinc has advanced to 15½¢ a pound in East St. Louis . . . Fort Monmouth, Signal Corps post, where much of the Army's communication equipment is developed, is providing television for all its enlisted personnel. There is to be one set for each company . . . Albert T. O'Neill, president of the Buffalo Niagara Electric Corp, has been appointed by the Buffalo City Council to a special committee which will draft a long-range program for the city.

Monsanto Chemical Co has settled its claims for loss resulting from the Texas City disaster for $17,312,000 . . . The Professional Engineers of Oregon want a change in the composition of the State Board of Engineering Examiners. One change would put two electrical engineers on the Board instead of one . . . Kentucky Utilities Co, which had planned to apply a fuel clause to bills of industrial and commercial users, has withdrawn its application to the PSC because of an improvement in company revenue . . . John Hunter, Springfield commissioner of public property, has been elected president of the newly formed Illinois Public Power Association, of which 24 municipals are members.

FINANCIAL:

The Securities and Exchange Commission has transferred its Baltimore Regional Office to Washington, where it will be known as the "Washington Regional Office" . . . The Virginia Corporation Commission has authorized Southern Indiana Gas & Electric Co and the Carolina Power & Light Co to sell common stock in Virginia . . . FPC has authorized Black Hills Power & Light Co to sell 5,000 shares of 5.4% cumulative preferred, $100 par value, and 33,730 shares of $1 common . . Public Service Co of New Mexico has declared a dividend of 25¢.

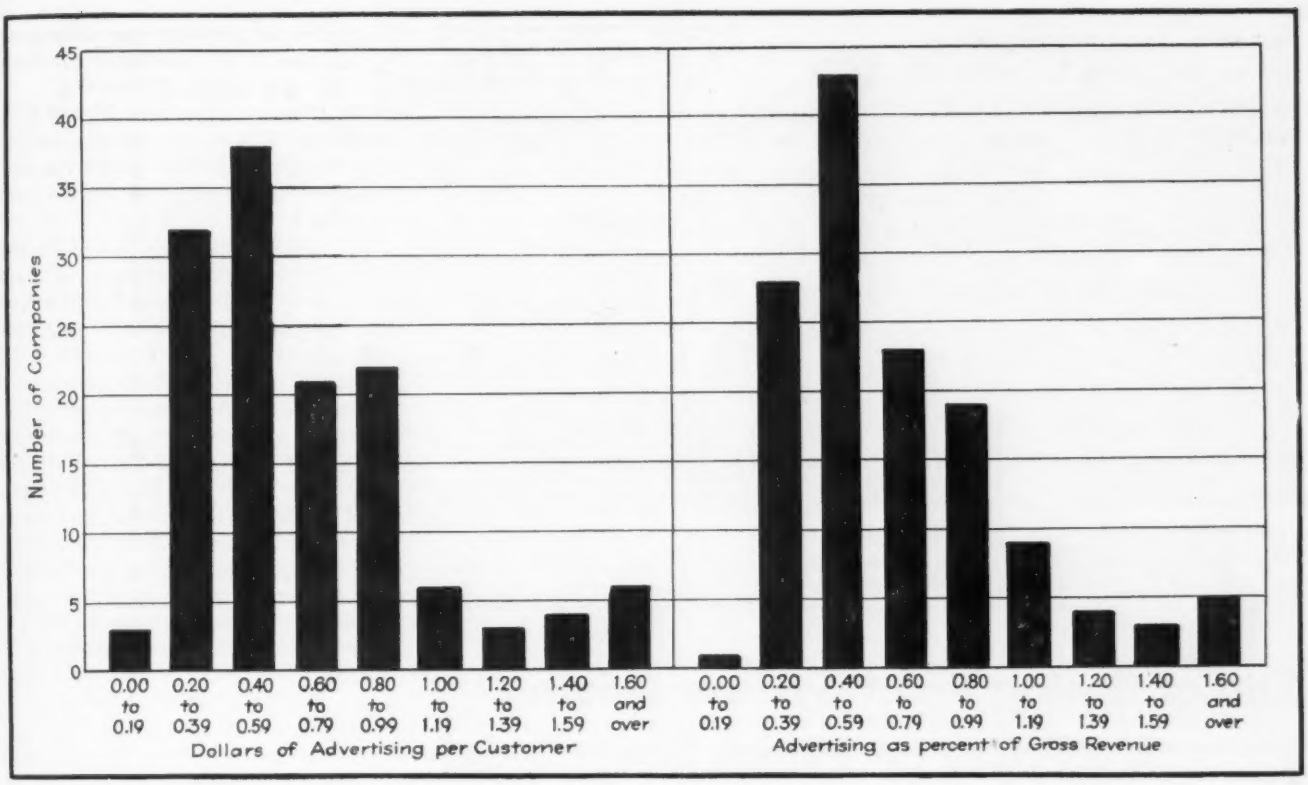
Detroit Edison Co stockholders have authorized the issuance of up to $47,000,000 of ten-year convertible debentures at the rate of $100 for each 15 shares of the capital stock of record on Nov. 10 . . . The North Carolina Utilities Commission has approved the sale of 60,000 shares of Tide Water Power Co common stock . . . Virginia Electric & Power Co will allow common stockholders to buy additional shares of $10 par common stock on a one-for-four basis.

SCULPTURAL RELIEF in new Mission Substation of Pacific Gas & Electric Co in San Francisco depicts the production of energy by use of hydro power. The sun (1) draws up moisture, which is precipitated as snow (2) and rain (3). From reservoirs (4) the stored flood waters pour through penstocks (5) to powerhouses. The tremendous force of the water—directed through turbines (6), Pelton water wheels (7), and generators (8)—produces electricity to operate the gears (9) and furnaces (10) of industry. A similar plaque depicts the production of energy in a thermal plant

CONSTRUCTION:

New York State Electric & Gas Corp has put its 35,000-kw Hickling Station at East Corning into operation on a test-run basis . . . Condemnation suits in Logan County are impeding construction of Illinois Power Co's 138-kv transmission line from Havana to Decatur . . . British Columbia Electric Railway Co has put the first 62,000-hp unit of its Bridge River hydro project into operation.

A steam generating station of 400,000 to 500,000-kw capacity is to be built by the Hydro-Electric Power Commission of Ontario at either Hamilton or Toronto . . . Looking to the future, San Diego Gas & Electric Co has purchased a 111-acre site 50 miles north of San Diego for a power plant . . . Consumers Power Co has placed in operation the first of three 80,000-kw units at its B. C. Cobb Plant at Muskegon, Mich. The second unit is to be ready in a few weeks . . . Tallahassee, Fla., has purchased 53 acres of land, 18 miles south of the city on the St. Marks River, as a site for its municipal power plant.



CHARTS showing advertising expenditures per customer (left) and as percent of gross revenue offer some guidance to . . . . . .

Utilities Probing Advertising Costs

How MUCH should a utility spend for advertising? How should the advertising dollar be divided?

To answer these two questions, the Public Utilities Advertising Association conducted a survey under the direction of Clarence L. Law, vice-president in charge of public relations for Consolidated Edison Co of New York.

Replies were received from 135 utilities. Of these, 42 were electric, serving 7,456,796 meters; 55 were combination, serving 12,881,379 electric and 5,105,116 gas meters; and 38 were gas, serving 6,556,119 meters. The electric meters represented 53%, the gas 54.1% of those connected at the end of 1947.

How much should a utility spend for advertising? (Advertising includes the 20 items in the table below.) The survey approached this question in two ways: in terms of dollars per customer, and in percent of gross revenue.

All companies spent an average of 59¢ per customer. Electric utilities averaged 76¢, combination companies 56¢, and gas companies 48¢.

In terms of percent of gross revenue, results were quite different. Average for all companies was 0.60%. Gas companies spent the most, 0.70%; followed in turn by electric utilities, 0.61%; and combination companies, 0.58%.

Percentage Distribution of Total Advertising Expenditures

	All Gas and Electric Utilities				Electric Utilities				Combination Utilities				Gas Utilities			
	Companies Reporting Item	Percent of Total Adv Expenditures			Companies Reporting Item	Percent of Total Adv Expenditures			Companies Reporting Item	Percent of Total Adv Expenditures			Companies Reporting Item	Percent of Total Adv Expenditures		
	Number	Avg	Max*	Min*	Number	Avg	Max*	Min*	Number	Avg	Max*	Min*	Number	Avg	Max*	Min*
Newspaper Advertising	133	32.0	100.0	4.7	41	34.5	100.0	10.3	54	31.8	90.4	15.1	38	28.3	83.6	4.7
Newspaper Adv Prod Cost	116	5.0	18.7	0.2	37	5.2	11.3	0.2	51	5.3	14.7	0.3	28	3.7	18.7	0.3
Radio	98	11.2	68.1	0.1	37	8.8	42.2	0.2	40	12.7	32.1	0.1	21	11.8	68.1	0.8
Billboard and Poster	90	6.2	24.8	**	31	5.5	16.2	0.2	35	5.4	23.8	**	24	9.9	24.8	0.3
Direct Mail	76	3.3	27.3	**	26	4.4	17.9	**	34	2.6	12.2	**	16	3.4	27.3	0.1
Window and Showroom Display	116	3.7	22.0	0.3	37	3.8	15.7	0.4	46	3.0	22.0	0.3	33	5.6	21.4	0.7
Exhibits and Fairs	90	3.2	45.2	0.1	29	4.3	45.2	0.1	39	2.6	23.9	0.1	22	3.4	13.2	0.5
Motion Pictures	40	2.5	16.6	**	11	7.0	16.6	**	20	0.9	12.9	0.1	9	3.4	9.2	**
Misc Catalogues	72	1.8	10.6	0.1	20	3.5	6.6	0.1	31	1.4	6.4	0.1	21	2.2	10.6	0.2
Dealer Helps	47	1.4	27.1	0.1	15	2.0	27.1	0.3	18	1.2	7.1	0.3	14	1.3	6.9	0.1
House Organ	87	6.6	33.3	0.2	30	5.2	20.8	1.2	40	7.9	32.0	0.5	17	5.0	33.3	0.2
Bill Inserts	64	6.0	16.1	0.1	14	8.2	12.8	1.4	29	5.6	16.1	0.2	21	4.0	9.1	0.1
Annual Reports	97	3.4	34.3	0.1	31	3.2	14.5	0.4	49	3.8	34.3	0.1	17	1.5	10.2	0.1
Salaries	94	12.6	56.1	1.0	33	11.8	33.8	2.9	37	13.8	32.4	1.1	24	10.5	56.1	1.0
Floor Space	44	3.5	58.3	0.1	14	4.4	15.2	0.4	13	2.1	4.9	0.1	17	5.8	58.3	0.3
Stationery and Supplies	91	2.6	34.7	0.1	33	2.0	34.7	0.1	35	1.9	14.4	0.1	23	5.8	32.5	0.2
Inseparable Items	11	12.6	63.3	0.9	5	13.1	37.3	0.9	5	12.9	63.3	2.5	1	6.3	6.3	6.3
Association Adv	103	8.7	32.2	0.1	29	9.1	24.4	0.1	46	8.1	24.7	0.1	28	10.0	32.2	0.2
Electric	(72)	(7.5)	(24.4)	(**)	(29)	(9.1)	(24.4)	(0.1)	(43)	(5.6)	(23.8)	(**)	—	—	—	—
Gas	(51)	(5.9)	(32.2)	(**)	—	—	—	—	(23)	(3.1)	(19.3)	(**)	(28)	(10.0)	(32.2)	(0.2)
Agency Commission	53	3.7	29.4	0.1	18	4.9	17.4	0.7	21	3.1	29.4	0.1	14	3.3	10.0	0.4
Surveys	15	1.3	5.4	**	5	2.2	5.4	0.5	10	1.2	3.1	**	0	—	—	—
Total Companies Replying	135				42				55				38			

*Maximum and Minimum are for individual companies. **Less than 0.1%

Prices in Cents per Pound as of Last Week of September

Grade	Basing Point	Multiple Basing Pt Pricing 1946	Multiple Basing Pt Pricing 1947	FOB Mill Pricing 1948
	SILICON SHEET			
Field	Pittsburgh, Chicago, Gary	3.9	4.5	5.15 Bu-IH
	Kokomo	4.0	4.6	
Armature	Pittsburgh, Chicago, Gary	4.25	4.8	5.45 Bu-V-IH-W
	Granite City, Kokomo	4.35	4.9	605 N
Electrical	Pittsburgh, Chicago, Gary	4.75	5.3	5.95 Bu-V-IH-W-BB
	Granite City, Kokomo	4.85	5.4	6.05 K, 6.15 G, 6.55 N
Motor	Pittsburgh, Chicago, Gary	5.425	6.05	6.7 Br-Bu-V-F-T-W-BB
	Granite City	5.525	6.15	6.9 G
Dynamo	Pittsburgh	6.125	6.75	7.4 F-T, 7.7 G 7.5 Br-Bu-V-BB
	SILICON SHEET—TRANSFORMER GRADE			
72	Pittsburgh	6.625	7.25	7.9 F-T 8.05 Z-Br-V-BB
65	Pittsburgh	7.625	7.95	8.6 Z-Br-V-F-T-BB
58	Pittsburgh	8.125	8.65	9.3 Z-Br-V-F-T-BB
52	Pittsburgh	8.925	9.45	10.1 V-F-T-BB

Br—Brackenridge, Pa.; Bu—Butler, Pa.; V—Vandergrift, Pa.;
K—Kokomo, Ind.; F—Follansbee, W. Va.;
T—Toronto, O.; G—Granite City, Ill.; IH—Indiana Harbor, Ind.;
N—Niles, O.; W—Warren, O.; BB—Beech Bottom, W. Va. Z—Zanesville, O.

End of Basing Point System Driving Up Prices on Silicon Sheet Steel

THE ELECTRICAL INDUSTRY is facing a serious situation in the new prices and production of silicon sheet steel. Cost and deliveries of power transformers which depend upon silicon sheet are getting out of line.

There appear to be three basic reasons for the present high price of electric sheet and strip steel. These are

1. Adverse rulings of the FTC and U. S. Supreme Court outlawing all basing point pricing, zone pricing, uniform delivery pricing, and systematic freight absorption.

2. A mill price increase averaging about 10% for most steel mill products.

3. A substantial boost in freight rates in recent months, which, taken in combination with the change in pricing forced on the steel (and other) industries with the voiding of the multiple basing point system, has had a substantial effect on steel prices.

Of the three points above, the voiding of the basing point system is by all odds the most important and far reaching in its effects. It should be noted that all steel products—structural as well as electrical sheet—are affected and that the situation also affects at least two other commodities (conduit and cement) that have an important bearing on the utility construction program.

The basing point system has been employed by the steel industry for 50 years, first using a single basing point (Pittsburgh) and since 1924 multiple (80) basing points. Under the multiple basing point system a customer in Dubuque paid a price for steel determined by prices quoted at the nearest of several (basing point) cities, regardless of where the steel was produced. In addition to this basing point price, he paid only the freight charges from the basing point to his plant. The supplier, of course, had to absorb the freight charges from his plant to the basing point. The end effect of the multiple basing point system was to permit steel producers, say, in Maine to compete with Texas producers for local business on the same price plane.

With the abandonment of the multiple basing point system by the steel industries in July, steel suppliers must now quote prices FOB their mills. The customer must now pay the freight from the suppliers' mills to his plant. This situation in combination with recent freight rate increases and the 10% average rise in the price of mill products has had the effect of boosting steel prices of many consumers higher than ever before. The situation is particularly hard on customers with long-term contracts with steel companies remote from their plant.

Another complicating factor in the death of the basing point system is introduced by the Robinson Patman Act, which requires all producers (not just steel alone) to quote the same FOB price to all customers of the same class. Thus a producer in Chicago quoting $50 FOB for a given quantity of steel plus $10 freight giving a delivered charge $60 in New York can be easily frozen out of the New York market by a local supplier with the same FOB price. And if the Chicago supplier changes his FOB price to get a given New York order, he must quote the same price to all customers of the same class regardless of location.

As of Jan 1, 1947, there were 13 manufacturers of electrical sheet according to the American Iron & Steel Institute. They were

**Allegheny Ludlum Steel Corp	Brackenridge, Pa.
**American Rolling Mill Co	Butler, Pa., Zanesville, O.
**Carnegie-Illinois Steel Corp	Vandergrift, Pa.
Continental Steel Corp	Kokomo, Ind.
*Empire Steel Corp	Mansfield, O.
**Follansbee Steel Corp	Toronto, O., Follansbee, W. Va.
Granite City Steel Co	Granite City, Ill.
Inland Steel Co	Indian Harbor, Ind.
*Newport Rolling Mill, Division of International Detrola Corp	Newport, Ky.
Niles Rolling Mill Co	Niles, O.
Republic Steel Corp	Warren, O.
**Wheeling Steel Corp	Beech Bottom, W. Va.
*Youngstown Sheet & Tube Co	Youngstown, O.

Today ten are publishing prices on electrical silicon sheet. The ones that have dropped out are marked thus (*). Only five are quoting on transformer grade steel as indicated by (**). Allegheny Ludlum and American Rolling

Shipments Electrical Sheets All Grades, Tons

	1946	1947	First 6 Mo 1948	Est Total 1948
All Market Groups	305,733	475,928	256,680	502,000
Elect. Machinery & Eqp:				
Power Gen & Dis	251,479	403,417		
Other Elect Eqpt	7,242	23,183		
Comm & Electronic	11,847	10,014		
Total	270,568	436,614	215,528	418,000
% Total Shipments to Elec Eqpt Mfrs	88.5%	91.5%	84.0%	

1948 Shipments of Electrical Sheets All Grades by Month

	Jan.	Feb.	March	April	May	June	July
Elec Machinery & Equipment	40,688	30,214	36,949	39,210	34,668	33,799	28,647
All Market Groups	46,959	34,360	44,938	46,514	42,013	41,896	36,119

Mills are not quoting on best grade transformer sheet.

Annual tonnage shipments of electrical sheet of all grades to all market groups and to manufacturers of electrical machinery and equipment are given on page 74 for 1946, 1947, and first half of 1948. Also given are tonnage shipments by months through July, 1948.

It will be noted that sheet for electrical equipment was 91.5% of the 1947 shipments but so far this year is only 84% (See table). Also the shipments to electrical equipment manufacturers have declined steadily since April this year, taking their sharpest dip in July when the pricing system was changed. Some transformer manufacturers report serious difficulties in deliveries, with delays becoming more prevalent. The loss of their silicon sheet producers compared with last year is having some effect. It is significant and disturbing that at a time when transformer capacity requirements are at the peak, deliveries of silicon steel are decreasing.

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PEA Engineers Relied On in Power Shortage

Officers of the Pennsylvania Electric Association are looking to the technical committees to be of positive help in "getting an extra squeal out of the pig" while the capacity shortage lasts. That was the message of President W. H. Doran to the Prime Movers Committee meeting at Warren on Oct 29 and 30. Topics of expedited overhaul and analyses of load pickup rate contributed directly to this objective.

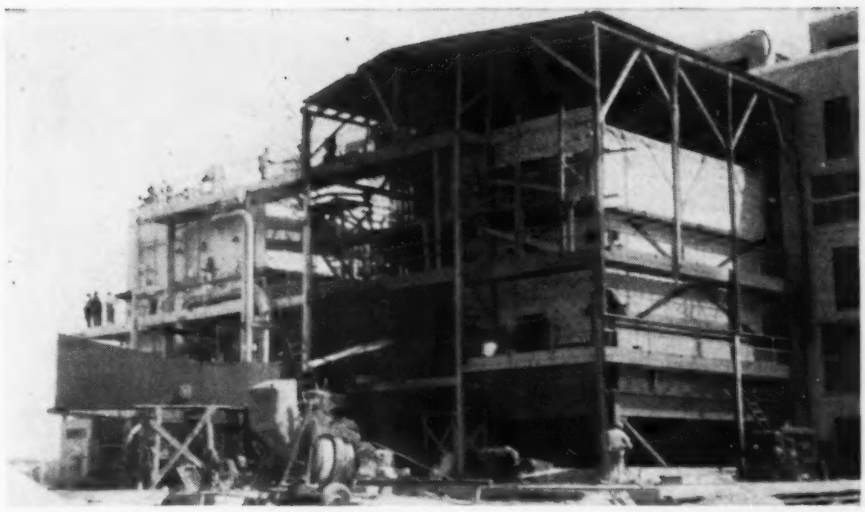
In the round table discussion, points were made in favor of testing high-pressure extraction-heater tubes at the factory at twice the working pressure. Electrostatic precipitators are rapped mostly on a "street light schedule," and several companies are contemplating dampers for sectionalization to escape such limitations.

Omission of deaerators was argued, and doubt was expressed whether the saving would not be offset by costs of testing associated with dependence on the condenser. Preponderance among new plants seemed to favor inclusion of the deaerator. Consensus was likewise in favor of acid-cleaning of new boilers and of blowing out steam lines before starting a new turbine.

Queries about the added cost of reheat installations brought forth an estimate of $10 per kw for a 1,250 psi, 950F station but, in return, a saving of $2 per kw-year in conjunction with a smaller condenser and 15% increase in capability.

The symposium theme of the meeting was boiler combustion control. Papers defining the philosophy and principles of action of their respective systems were presented by E. D. Scutt, Leeds & Northrup Co.; H. R. Fulton, Bailey Meter Co., and M. J. Boho, Hagan Corp. Scutt urged that the control system be decided at the very start of a station design and not as an afterthought. He prophesied that tie-line load control would shortly be coordinated with turbine and boiler controls. Fulton said multielement controls are coming into increased use for superheat regulation. Also there is a tendency to omit dispensable instruments (especially the large ones which Vice-President Sontum of the host Penelec utility had wished could be as small as the associated electrical ones) from panels and place them elsewhere. Boho cited the reserve continuity of pneumatic controls in times of electrical emergencies and the ease with which supplementary functions can be combined.

The 40 members and guests visited the newly energized Warren Station (an early issue of ELECTRICAL WORLD will have an article) and the pressure-vessel heat-exchanger plant of Struthers-Wells.



SECOND BOILER now being installed at the Lieberman Plant of Southwestern Gas & Electric Co on Caddo Lake, 15 miles northwest of Shreveport, La., will provide steam for second 25,000-kw unit scheduled for operation next March. First unit went on the line in July, 1947

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New Safety Manual Out

Safe handling of electric lines and proper use of rubber protective equipment to prevent shock and burn accidents in work areas are described in "The Application and Care of Rubber Protective Equipment," a 31-page safety manual just published by the Accident Prevention Committee of the Edison Electric Institute. The new booklet is available from the Edison Electric Institute, 420 Lexington Avenue, New York 17, N. Y., at 25 cents a copy.

C of C Hits at Proposal for TVA Steam Plant

The opening blast in the anticipated renewal of the fight over a proposed Tennessee Valley Authority steam plant has been fired by the U. S. Chamber of Commerce.

The blast was in the form of a revised analysis of TVA power operations. The analysis was accompanied by a statement concluding that the Tennessee Valley could, and should, get additional energy "without new steam-electric stations built by the federal taxpayers."

Local chambers of commerce and the national body were among the most effective opponents of TVA's request for funds to start a steam generating plant at New Johnsonville, Tenn. The proposal was voted down by Congress last summer by a narrow margin. A similar request has been included in TVA's budget for the next fiscal year and will be presented to Congress again in January.

The analysis of TVA activities was prepared in 1945 by C. J. Green, an engineer and former staff member of both the Federal Power Commission and Oregon's Public Service Commission. The revised edition of the Green report updates its findings to include TVA's operations from May 18, 1933, to June 30, 1946. It compares TVA's power costs with those of a hypothetical corporation operating the same facilities. Such a utility company would have required nearly $280,000,000 more income to stay in business.

Green reached this conclusion by totaling the extra expenses the utility would have to pay but TVA does not. These items are $155,287,363 for taxes, $174,819,922 for interest in investment,

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING SEPTEMBER

Utility	Plant	Fuel	Capacity (Kw)
Public Service Co of New Hampshire	Conway	IC	2,000
Public Electric Light Co (Vt.)	Milton, No. 2	H	5,000
Green Mountain Power Corp	Hardwick, Vt.	IC	675
Cincinnati Gas & Electric Co	West End	S	35,000
Brookston Municipal Light Dept	Brookston, Ind.	IC	343
Presque Isle County Electric Cooperative Assoc	Tower, Mich.	IC	1,169
Coldwater Board of Public Works	Coldwater, Mich.	IC	1,000
Petoskey Electric Light Dept	Petoskey, Mich.	IC	3,000
Alexandria Board of Public Works	Alexandria, Minn.	IC	1,250
Otter Tail Power Co	Hook Lake, Minn.	S	7,500
Interstate Power Co	Lansing, Ia.	S	15,000
Iowa Electric Co	Dewitt	IC	2,000
Tyndall Light & Water Dept	Tyndall, S. D.	IC	564
Northern States Power Co	Lawrence, S. D.	S	12,500
Trenton Electric Light Dept	Trenton, Neb.	IC	250
Kansas Gas & Electric Co	Ripley	S	25,000
Florida Power Corp	Apalachicola	IC	1,000
Conway Light, Power & Water Dept	Conway, Ark.	IC	1,250
Duncan Electric Dept	Duncan, Okla.	IC	1,400
Idaho Power Co	Lower Malad	H	13,500
Mountain States Power Co	Lander, Wyo.	IC	1,000
Black Hills Power & Light Co	Osage No. 2, Wyo.	S	10,000
Public Service Co of Colorado	Lacombe	S	35,000
Pacific Gas & Electric Co. (Calif.)	New Electra	H	89,100

PLANT RETIREMENTS DURING SEPTEMBER

West Penn Power Co	Kane, Pa.	IC	440
West Penn Power Co	Coudersport, Pa.	IC	320
Presque Isle County Electric Cooperative Assoc	Tower, Mich.	IC	160
Shelbina Water & Light Dept	Shelbina, Mo.	IC	136
Otter Tail Power Co	Lisbon, N. D.	IC	250
Ocala Light & Water Dept	Ocala, Fla.	S	870
Bardwell City Utilities	Bardwell, Ky.	IC	60
Conway Light, Power & Water Dept	Conway, Ark.	IC	200
Duncan Electric Dept	Duncan, Okla.	IC	400
West Texas Utilities Co.	Valentine	IC	110
Fall River Rural Electric Cooperative, Inc	West Yellowstone, Mont.	IC	110

H—Hydro, IC—Internal Combustion, S—Steam.
United States Capacity as of Oct. 1,—Steam, 37,648,944 kw; Internal Combustion, 1,527,452 kw; Hydro, 15,566,259 kw; Total, 54,742,655 kw.

and $165,282,781 for adjusted operation cost. They total $495,390,066. Deducting TVA's revenue for the period leaves the private utility a deficit of $279,646,691.

The adjusted operation cost was based on the increased allocation to power, which would be nearly one third above TVA's.

Prefacing these studies, the Chamber urged that other means of providing additional power for the TVA area be utilized in preference to building the New Johnsonville plant. Among them were the following:

1. Construction of steam plants by large municipalities served by TVA.
2. Installation of plants by TVA's big industrial customers.
3. Purchase of off-peak energy from neighboring utilities.
4. Cancellation of TVA energy sales to utility systems.
5. Purchase by TVA of firm power from other utilities.

The Chamber discounted TVA's claim that it alone must supply the area's entire power needs. It continued:

"If such a claim has validity, then any federal bureau can make a similar claim, pick the extent of territory it wants to preempt, extend it as far as it wishes, and . . . obligate the federal government to supply the unlimited needs of such an area."

Judge Denies New Trial in Condemnation Suit

A motion of the Stevens County PUD, Colville, Wash., for a new trial of its condemnation suit against the Washington Water Power Co, Spokane, has been denied by Superior Judge B. B. Horrigan.

The PUD asked for a new trial on the grounds of jury misconduct and because of an "excessive and unjust" award by the jury, which had fixed the price of the power company's property in the county at $2,500,000. Judge Horrigan said he could find no evidence of willful neglect or misconduct on the part of the jurors and pointed out that in fixing the price they "accepted figures that were within the evidence given by competent men and it was in their province to do so."

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Plans Rural Power Study

The executive committee of the Nebraska Association of Rural Public Power Districts has engaged the Stanley Engineering Co, Muscatine, Iowa, to make a statewide power system study. The firm also will help negotiate wholesale power rates and take other needed steps to assure an adequate supply of cheap power for the rural projects.

3 Utilities Act to Reduce Peak Energy Demands

Three utilities acted last week to reduce the use of electricity during daily peaks. As usual, large commercial and industrial users were the first asked to make the reduction.

Puget Sound Power & Light Co, Seattle, has cut off power to some 40 customers on interruptible contracts during the daily 4:30 to 6 P.M. peak. Similar steps have been reported taken by other Northwest utilities.

Aluminum companies, served directly by Bonneville Power Administration, are expecting notice to shut down some of their potlines.

Indiana & Michigan Electric Co, part of American Gas & Electric's Central System, asked its industrial customers to make voluntary adjustments in their demands during peak periods to avoid the necessity of curtailment.

Duquesne Light Co, Pittsburgh, asked 500 of its largest commercial and industrial customers to reduce consumption 15% from 8 A.M. to 9 P.M. Monday through Friday, from Dec 1 to March 1.

The utility suggested that the customers could cooperate by using only the power absolutely needed during the peak period and by rescheduling operations to nights, Saturdays, and Sundays.

In Duluth, served by the Minnesota Power & Light Co, the City Council declared a state of emergency and appealed for a 20% voluntary reduction in power use. The city has restored the wartime dimout. Shortage of water for generation of power is blamed. September was the driest in 77 years.

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VEPCO Asks License for Roanoke River Dam

Virginia Electric & Power Co has asked the FPC for a license to build an $18,000,000 dam and power plant on the Roanoke River.

The structure would be erected at the site of an existing diversion dam at the head of Roanoke Rapids in North Carolina. The powerhouse would contain three 28,000-hp and one 14,000-hp generating units. The dam would create a reservoir 7½ miles upstream.

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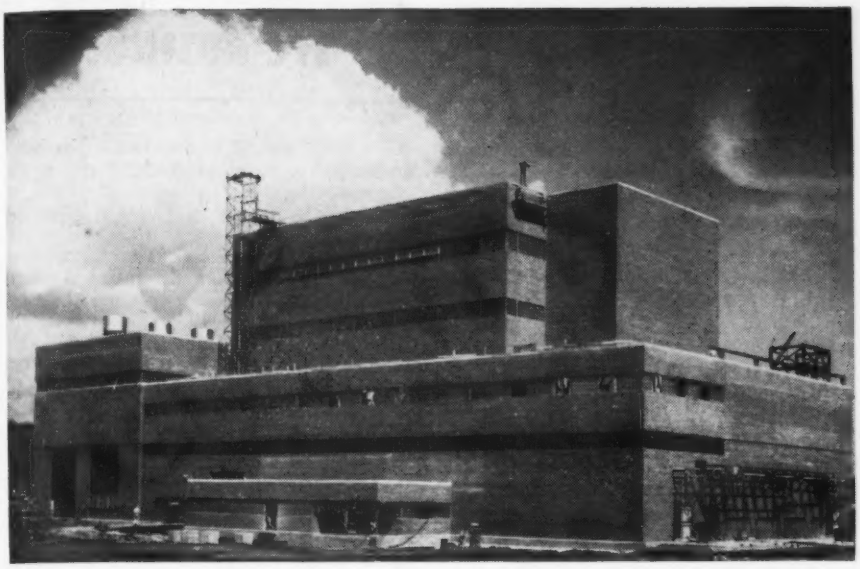
Free Installations Ended

Commonwealth Edison Co, Chicago, no longer installs electric ranges and water heaters without charge. Under the new policy, the customer will pay $10 for installing a new range and $20 for a hot water heater. The utility will underwrite the remainder.



NEARING COMPLETION is this $11,800,000 Willow Island Plant of the Monongahela Power Co near St. Marys, W. Va. Initial capacity of the plant is to be 50,000 kw

Utility Inventories Level Off After Rapid Increase

Inventories of the power companies are always important, but today they are being watched with more than casual concern. Material and supplies accounts have expanded rapidly since the war. Obviously fuel has increased because of the substantial price increases and the desire of utilities to protect against shortages due to strikes and other supply problems.

Materials other than fuel have increased because of price increases and scarcities which required advance purchases rather than as needed from manufacturers' stock. Delays in use of equipment on large construction jobs because of lack of some important component materials have contributed to growth of inventories.

A sample of the materials and supplies account excluding fuel of 12 representative utilities shows a total of $39,000,000 as of Jan 1, 1947, $60,200,000 as of Jan, 1948, and the following totals for the first day of each month in 1948:

February	$59,800,000
March	60,900,000
April	62,800,000
May	64,600,000
June	65,600,000
July	67,800,000
August	66,200,000
September	66,300,000
October	66,200,000

From the first of 1947 to October, 1948, the income was 70%. It is obvious, however, that the trend shows indications of leveling off at the midyear total.

The need for funds for capital additions is one reason why the inventory account is so important. It is much to the advantage of utilities to keep this item down so that the equivalent property can be put into electric plant. One utility is controlling inventory on the basis of dollars rather than units. Then if prices rise the number of units is automatically reduced.

Manufacturers of electric equipment are vitally interested in the inventory position and controls placed upon it. Recent drop in demand for some normal inventory items is explained by the fact that total material and supplies accounts have stopped growing. This may even indicate a gradual reduction in the inventory units because of the constant increase in average cost of supplies. As major construction jobs are completed, the inventory accumulation of such material may very well reduce the total dollar volume of the account.

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Residential Rate Altered to Allow Heat Pump Use

In order to provide service for heat pump and air-conditioning installations and for additional use of motor-driven equipment on farms, the Indianapolis Power & Light Co has changed its residential rate restrictions.

Under the new rules, the use of 5-hp motors is permitted on the residential rate. Formerly, 3-hp was the maximum. This rate, as previously, is limited to single-phase service.

Heat-pump installations are growing in popularity in the Indianapolis area. Although 3-hp motors are satisfactory for small home installations, it has been found that one or more 5-hp motors will be required for most residences in the prospective heat-pump market.

West Industrially Mature, Tenney Assures PCEA

The wartime establishment of the metallic base necessary for maturing any industrial economy has assured the industrial maturity of the West. Proof of this was given last week by George C. Tenney, publisher of *Electrical West*, at the fall conference of the Pacific Coast Electrical Association at Fresno.

He pointed out that in 1939 more than half the jobs in the West were in the wood or food processing industries. Today the metal and chemical industries have more than trebled and alone represent more jobs than the wood and food industries combined. With the continued growth in industry, population, and purchasing power, Tenney predicted for the West one of the greatest periods of growth and prosperity ever recorded.

To realize the full potential of such industrial development, A. Martin, General Electric Co, discussed the problem of releasing human potential through human management. He stressed the responsibility of management to see that those appointed bosses will gain and deserve acceptance as leaders.

In a session on "Modern Methods of System Dispatching," I. W. Collins, Pacific Gas & Electric Co, discussed briefly the factors dictating continuation of Daylight Saving Time in California. Although only a small amount of energy will be saved, system demand will be 365,000 kw less.

Experience of Pacific Gas & Electric with a wide variety of underground systems installed since 1935 was presented before the Transmission and Distribution group by B. L. Peter. The systems in most cases were both primary and secondary buried directly in the ground, with transformers in protective enclosures above or partly below ground. Costs varied from two to five times the equivalent overhead construction, with the difference paid by the person owning the subdivision where the underground system was installed.

High-speed motion pictures in color of standard 12-kv line switches de-energizing lines carrying shunt capacitors were presented by G. L. Hill, also of PG&E. Recommendations for modifications of the switches will probably be made when further tests are completed.

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Shelby Plans Addition

The Shelby, O., City Council has approved a $664,000 improvement project for the municipal light plant. Included is installation of a 5,000-kw turbine generator, cooling tower, and other auxiliary equipment.

Administrators to Run California UWU Locals

Two administrators have been named to run the affairs of four California locals of the Utility Workers Union, CIO, following suspension of the local union officers for "wrongful conduct." They are Edward Shedlock, Wilkes Barre, Pa., executive board member, and National Representative William Agers, San Francisco.

The local officers were suspended and the administrators appointed by the national executive committee pursuant to a resolution of the recent UWU convention in Washington. The local officers will be given a hearing by the national committee in San Francisco on Nov 30.

The action followed charges that the officers, whose local unions represent Pacific Gas & Electric Co employees in San Francisco, Redwood City, Martinez, and Santa Rosa, failed to cooperate with the UWU national officials and, more important, were trying to make a switch to the rival International Brotherhood of Electrical Workers, AFL. The IBEW represents employees in other parts of PG&E.

Harry Doyle of the PG&E local in Oakland is the only new figure among UWU top officials. The convention elected him to James L. Daugherty's place as executive board member from the West Coast. Daugherty was removed a year ago for refusing to sign a non-Communist affidavit.

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Demand on PG&E Called Federal "Foot in Door"

The government's demand that Pacific Gas & Electric Co "wheel" power to federal agencies in California was protested as a "foot in the door" to get the Bureau of Reclamation into the commercial power business at opening sessions of a State Public Utilities Commission hearing last week in San Francisco.

The government is asking that the PUC compel PG&E to deliver power to 28 federal agencies using a minimum of 500 kw in exchange for power obtained from federal generating plants, charging only a rental fee for transmission.

The case has been said to be headed for the Supreme Court in a test of Reclamation law on the sale of government-generated power.

Colin A. Smith, special assistant to the U. S. Attorney General, complained that the United States is being charged full commercial rates for power at its various military establishments without consideration of the fact that it produces and supplies that power at "very favorable rates." He termed the charges of PG&E to the government "unreasonable and excessive."

Robert N. Gerdes, general counsel for PG&E, commented that those rates were fixed under the jurisdiction of the PUC. He added that the power supplied to government agencies is not exclusively Shasta or government-generated power, but company power produced or obtained from numerous sources.

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$1,000,000 Suit Brought on Atomic Ban of UEW

A $1,000,000 damage suit has been filed against General Electric Co and members of the Atomic Energy Commission by the United Electrical, Radio and Machine Workers, CIO, protesting the union's blacklisting in atomic plants.

The action was based on an order by David E. Lilienthal, AEC chairman, directing the company not to recognize the union as bargaining agent in two plants GE operates for the Commission. Lilienthal's order cited, among other things, the refusal of union officials to sign non-Communist affidavits under the Taft-Hartley Act.

Political control over the union would result from enforcement of the order, the union said, charging it violated the First, Fifth, Ninth, and Tenth Amendments to the Constitution.

MEETINGS

Association of Edison Illuminating Companies—Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., November 17-19. F. V. Magalhaes, secretary, 4 Irving Place, New York 3, N. Y.

PREVIOUSLY LISTED

National Electrical Manufacturers Association—Annual Meeting, Hotel Traymore, Atlantic City, November 8-13.

Southeastern Electric Exchange—General Sales Conference, Atlantic Biltmore Hotel, Atlanta, Ga., November 10-12.

National Association of Railroad and Utilities Commissioners—Annual Meeting, General Oglethorpe Hotel, Savannah, Ga., November 15-18.

National Farm Electrification Conference—Congress Hotel, Chicago, November 17-19.

New Jersey Utilities Association—Annual Meeting, Seaview Country Club, Absecon, November 18-20.

American Society of Mechanical Engineers—Annual Meeting, Hotels Pennsylvania and New Yorker, New York, November 28-December 3.

National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, November 29-December 4.

National Electrical Contractors Association—Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

SEC RULINGS

United Light & Railways Co has been authorized to distribute and transfer to its common stockholders, as a dividend in kind, 61,216 shares of common stock of American Light & Traction Co of the par value of $25 per share. The commission ruled the distribution and transfer as necessary or appropriate to effectuate the provisions of Section 11 (b) of the Public Utility Holding Company Act of 1935. (Release No. 8583).

North American Co has been authorized to sell and transfer 2,563 shares of Pacific Gas & Electric Co common stock as necessary or appropriate to the integration or simplification of the holding company system of which The North American Co is a member. The commission ruled the action as necessary or appropriate to effectuate the provisions of Section 11 (b) of the Public Utility Holding Company Act of 1935. (Release No. 8586).

Electric Bond & Share Co has been authorized to purchase not more than 17,500 shares of the common stock of the Carolina Power & Light Co for the purpose of stabilizing the market. (Release No. 8591).

Public Service Co of New Hampshire has been authorized to sell $7,000,000 in first mortgage bonds. The securities will be offered at competitive bidding and $3,600,000 of the proceeds will retire short-term bank loans. The balance will be used for company expansion. (Release No. 8570).

•

Co-op Probe Demanded

The City of Cadiz, Ky., has complained to the Public Service Commission that the service it gets from the Pennyrile Rural Electric Co-operative is "generally inadequate and unsatisfactory." The complaint charges that "there are too many customers for the co-op's capacity, voltage is too low, lines are overloaded, and there are too many customers per transformer in use."

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Cornell Opens Atom Lab

A $2,000,000 laboratory of nuclear studies was dedicated recently by Cornell University, Ithaca, N. Y., as part of its eightieth anniversary celebration. Equipment includes a 300,000,000 electron-volt synchrotron, at present exceeded in energy only by the 184-in. cyclotron used by the University of California at Berkeley.

•

Iowa Franchise Extended

Voters of Ottosen, Iowa, have okayed a 25-year renewal of the Iowa Public Service Co's franchise.

Output in Canada Pushed to Record High for August

Canadian central stations pushed their August output to 3,699,472,000 kwhr in August, hitting a record high for that month. Another record monthly high was set when consumption of primary power reached 3,414,109,000 kwhr.

Output for the first eight months of 1948 was slightly behind that for the corresponding period of 1947. However, several new plants have gone on the line during the past month; so it seems assured that output for 1948 will exceed that for 1947.

The following statistics reported by the Dominion Bureau of Statistics are in thousands of kilowatt hours:

Period	1948	1947
Eight months	29,915,447	30,190,714
Primary	27,840,038	25,331,611
Secondary	2,075,409	4,859,103
Primary Consumption	26,944,441	24,388,469
Exports to U. S.	1,161,010	1,483,589
August	3,699,472	3,641,476
Primary	3,528,465	3,168,385
Secondary	171,007	473,091
Primary Consumption	3,414,109	3,060,134
Exports to U. S.	138,134	195,889
July	3,664,554	3,750,881
Primary	3,478,025	3,173,552
Secondary	186,529	577,329
Primary Consumption	3,362,866	3,048,702
Exports to U. S.	150,940	217,171

First Court Ruling Asked on Massachusetts Rates

The Supreme Judicial Court of Massachusetts has been called upon to determine the validity of utility rates established by the State Department of Public Utilities.

In the first such case ever taken to the high court, Lowell Gas Light Co. Lowell, charges the rates granted are so confiscatory as to be unconstitutional. The Attorney General's office denies that rate regulation involves confiscation or any violation either of the federal fourteenth amendment or the Massachusetts Constitution. In the absence of any set legislative formula, the regulatory agency has adhered to the "prudent investment theory" in deciding rates. Under the rates granted the company has prospered, the Attorney General's office claims.

Other News

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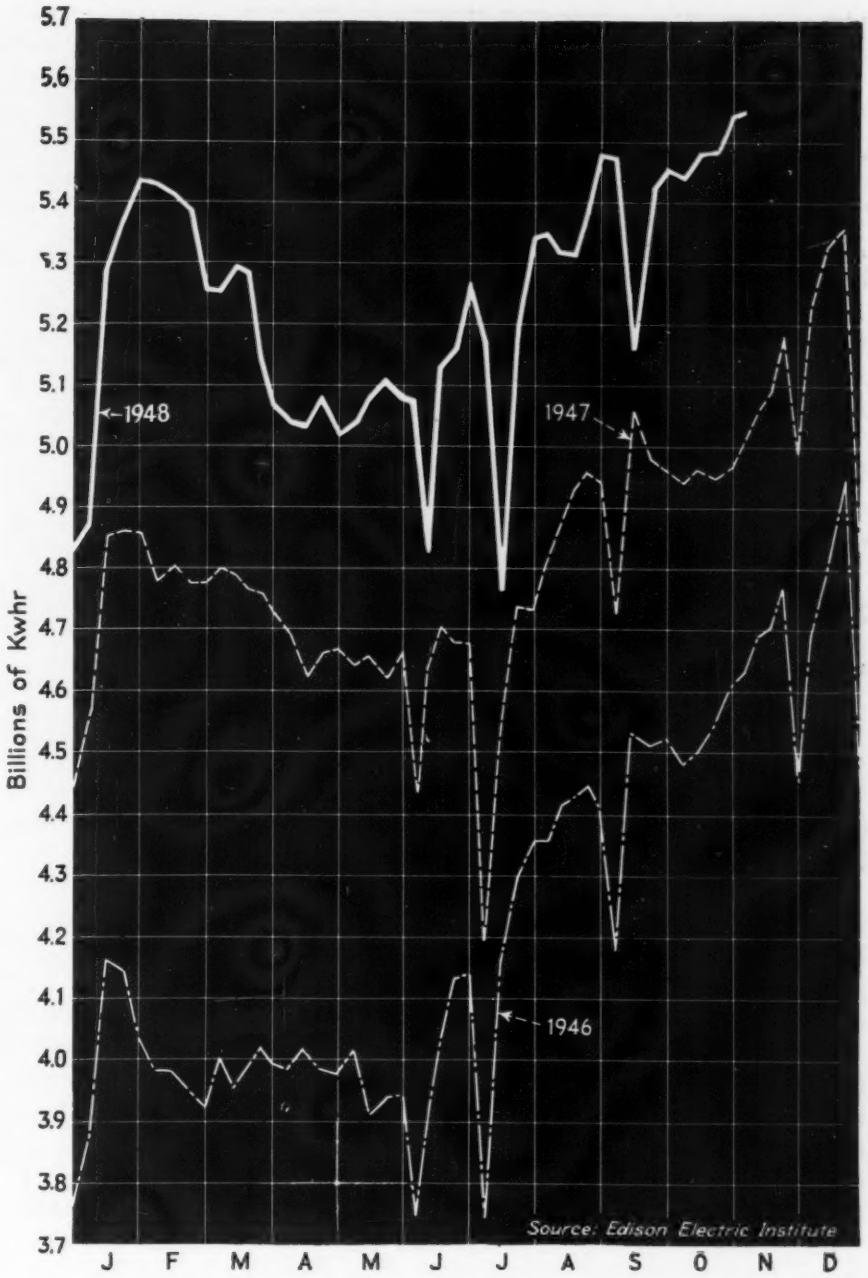


Output Reaches Record 5.55 Billion Kwhr

Another weekly output record, the fourth in a row, was set in the week that ended Oct 30. The total was 5,555,254,000 kwhr, 10.9% higher than for the corresponding week of 1947. This increase is slightly below that for the previous week but is still a danger signal.

Capacity is being added, but as of Oct 1, the increase over Dec 31, 1947, was only 4.84%. As last year ended, the utilities had 52,211,488 kw on the line. On Oct 1 the total was 54,742,655 kw. But even more serious is the location of the additional units. Some sections benefited greatly, others very little. The latter may be in desperate shape when the December peak arrives.

Lack of rainfall in many sections is adding to the difficulties of the utilities by cutting hydro output and forcing more load on steam plants.

Weekly Output, Millions Kwhr

1948	1947	1946
Oct 30 5,555	Nov 1 5,009	Nov 2 4,628
Oct 23 5,539	Oct 25 4,964	Oct 26 4,602
Oct 16 5,482	Oct 18 4,946	Oct 19 4,540
Oct 9 5,482	Oct 11 4,958	Oct 12 4,495
Oct 2 5,449	Oct 4 4,935	Oct 5 4,478
Sept 25 5,461	Sept 27 4,956	Sept 28 4,518
Sept 18 5,426	Sept 20 4,977	Sept 21 4,507
Sept 11 5,166	Sept 13 5,053	Sept 14 4,521
Sept 4 5,470	Sept 6 4,721	Sept 7 4,184

Percent Change from Previous Year

	Oct 30	Oct 23	Oct 16
New England	+ 4.6	+ 7.1	+ 6.0
Mid-Atlantic	+ 6.8	+ 8.2	+ 6.2
Central Industrial	+ 9.6	+12.2	+11.7
West Central	+10.7	+12.7	+11.6
Southern States	+13.6	+11.8	+11.6
Rocky Mountain	+25.5	+16.8	+14.6
Pacific Coast	+14.4	+13.9	+14.0
Total United States	+10.9	+11.6	+10.8

WASHINGTON COMMENT

WILLIAM B. WHICHARD

DESPITE opponents' charges that he was not specific, Candidate Tom Dewey had a lot to say about public power during his Presidential campaign. Harold Ickes and other Democratic spokesmen notwithstanding, the GOP candidate expressed definite views on several hotly disputed power issues. He summed up the most important in a press conference in September.

Dewey repeated statements he had made earlier, to the effect that he favored further development of Western rivers for conservation, power, navigation, flood control, and irrigation. Then he got down to cases.

He told reporters that he favored federal construction of transmission lines from government plants.

He frowned on the proposed creation of TVA-type authorities to develop river basins, but said TVA will be "left as it is."

He backed TVA's reviving proposal to build a steam-generating station at New Johnsonville, Tenn.

That's a lot more specific than people in the power business wanted him to be on these issues, especially on the New Johnsonville plant.

It appears then that support for the New Johnsonville plant will be forthcoming from whoever happens to be President. The bitter congressional battle for the steam plant last summer can very well be repeated with the outcome depending on control of the House.

All the influence Harry Truman could muster for TVA in that fight was not enough to get TVA an appropriation to start construction of the plant. A hard core of opposition in the Republican-controlled House twice voted down the funds, then repeated the performance after the Senate had approved the plant.

But Truman's influence with the 80th Congress—or rather, his lack of same—is one thing. The prospects for the new President to put across the TVA steam plant will again depend upon the influence which he has in the House. Such changes which are made in this makeup will make little difference in the problem facing the chief executive.

The House again is the place where opponents of TVA expansion must beat New Johnsonville, if they are to beat it at all. No conceivable change in Senate membership is likely to make victory possible there.

The steam plant issue already is on its way back to Congress. Another request for an initial appropriation is in TVA's 1950 budget estimate. This item, together with the rest of the next federal budget, will be sent to Congress by President Truman early in January. A new administration would revise parts of the budget after Jan 20. But there is little chance that such a revision would be so extensive as to include review of TVA's program. There simply would not be time after Jan 20 for a complete overhaul of all appropriation requests.

Thus, last year's Congressional battle over the New Johnsonville plant is set for another performance. The backers of each side will again have to appear and present their arguments on both sides of the issue. The severe power shortage will aid the sponsors of New Johnsonville along with the continued threat of war.

So opponents must now be preparing for the battle in the spring.

TECHNICAL TRENDS

ARCHER E. KNOWLTON

Mobile radio would give good returns in improved service and bettered public relations, even if it did not save a man-hour or a mile of truck travel.

Textile mill drives of the group-drive kind still exist but continue to yield to individual drive. The added expense is reported liquidated by avoidance of shaft and belt maintenance, greater flexibility in arrangement and far better working conditions.

Cable splicing is done by one utility from a commercial high-headroom milk truck adapted solely by installing bins inside and a vise at rear sill.

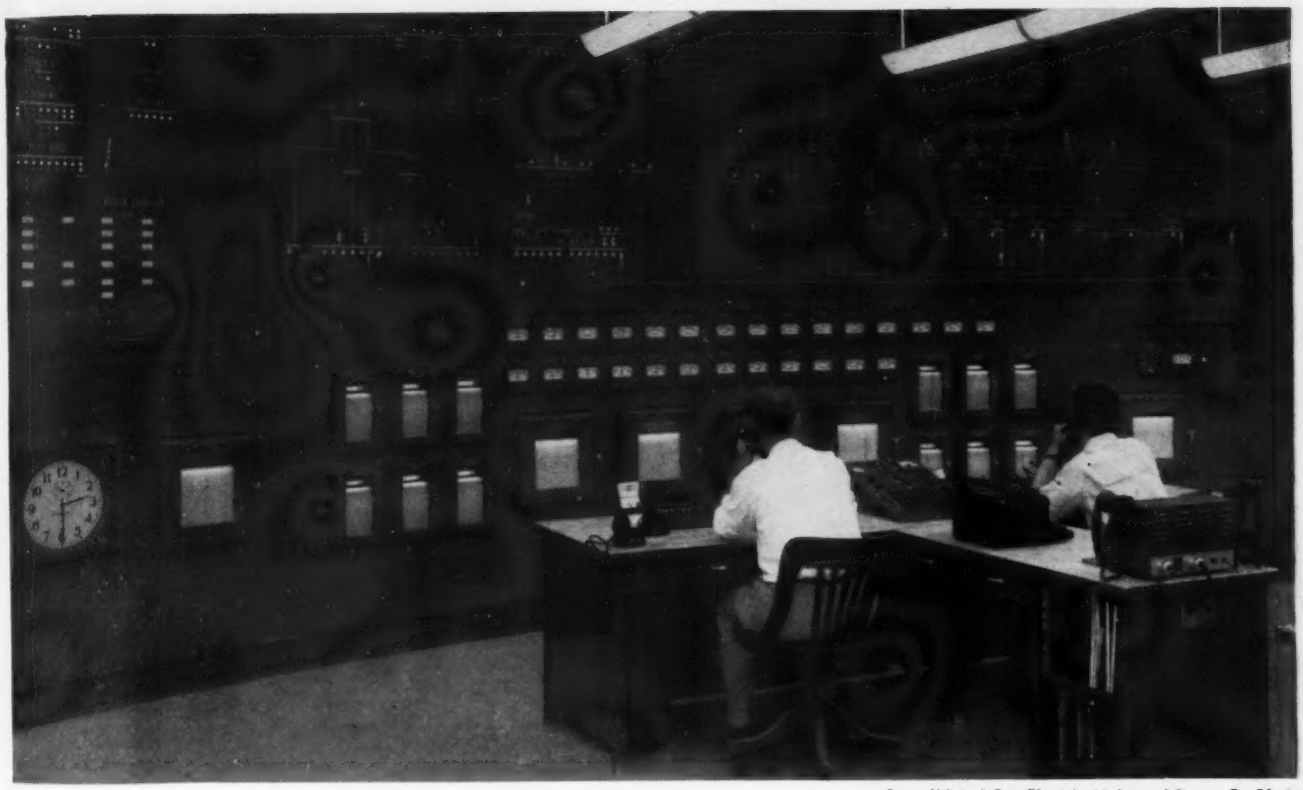
Circuit breakers of old vintage are not necessarily inadequate when rerated to meet today's concepts of performance, if the duty and operating conditions are unchanged. The trouble is that both have almost assuredly changed.

Light-colored raincoats are wanted by utilities as a safety measure at less cost than the white ones used by police and fire departments. High-visibility yellow is a proposed solution.

Ladder specifications of utilities are more stringent than many manufacturers can meet with lumber quality as it is. Aluminum is viewed as the alternative but with a sacrifice in insulation attributes.

Universal demand registers can be more attractive to meter departments than the direct reading type but the prevailing diversity in preferences as to scale class must first be resolved.

Soot and flyash are not alone in causing pollution of the atmosphere. Blown soil, leaf powder, industrial abrasion products, even cosmic dust are known to be contributing factors. Identification of the component deposits can absolve utility smoke of all but its share of the responsibility.



Consolidated Gas Electric Light and Power Co Photo

ALLOCATING LOAD to generating plants is an increasingly important and complex operating problem

System Load Allocation Based On Mw Peak and Mwhr Consumption

Technique allows long range scheduling of maintenance outages since peaks and base loads are assigned on basis of percentage of system capacity. Figures not materially affected by daily load variations

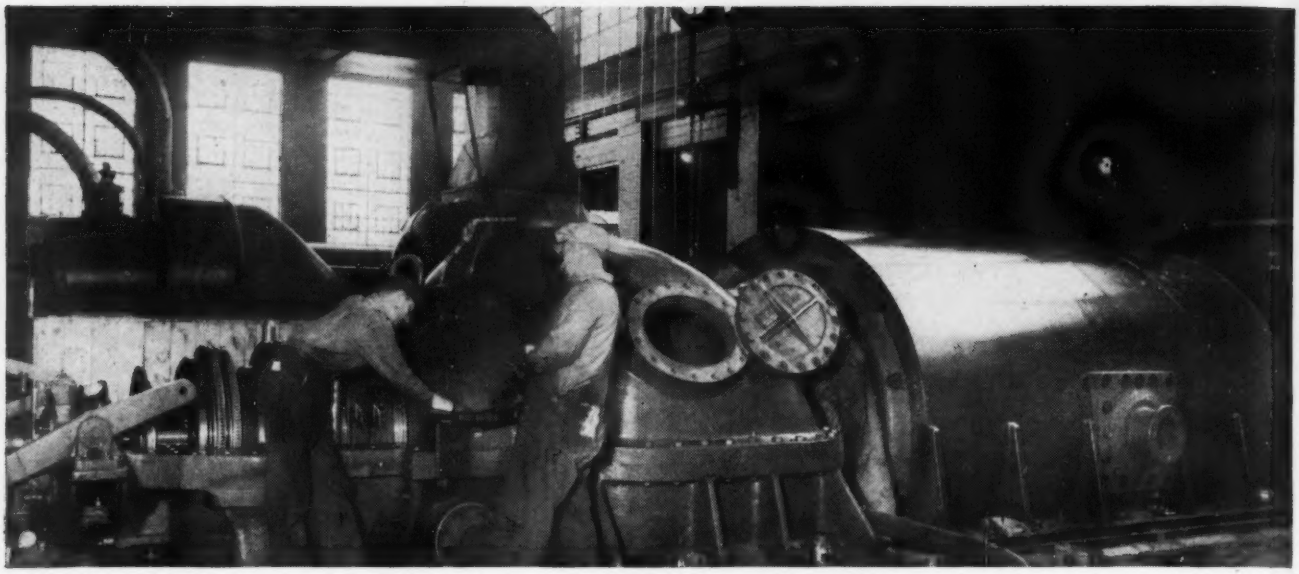
RICHARD W. KENDALL
Public Service Co of Oklahoma

ALLOCATION of system load to generating plants is one of the complex operating problems that have increased in magnitude as a result of the industry's phenomenal growth. Involved are heavier loads, new plants with greater capacities to serve those loads and old plants with units, which, sooner or later, will necessitate scheduled maintenance outages. The problem then is to find a technique of allocating loads on a long term basis so that the maintenance outages can be scheduled.

The technique must take into consideration two factors—ability to serve the peak load and ability to deliver the electrical energy.

Today a single company may have twenty or thirty stations ranging in size from 10,000 to 100,000 kw. The problem then resolves into one of allocating a certain number of hours of operation per year to each plant or unit in the system. Economy and service conditions are of principal importance. To further reduce production costs, close efficiency checks are made on each plant and more efficient plants are given a greater number of scheduled hours operation each year than the less economical stations.

Referring to the typical "load-duration" curve shown in Fig 1, the portion of the graph under the dashed line is called the "base load" and runs for one full year, or 8,760 hr. The upper area, marked "peak load", is carried for the number of hours a particular demand is on the system. The base load, which must be carried every hour of the year, is allocated to the most economical plants in the system. The peak load may be allocated to less efficient stations in the system and in some cases their continual operation throughout the year may not be necessary.



ACCURATE PLANNING of load allocation simplifies inspection and maintenance schedules

The cross-hatched area of the peak load has only a few hours duration each year and can be drawn from the least economical normally scheduled units.

The problem is specifically one of scheduling, or allocating, portions of this yearly load to the various generating plants throughout the system on the most economical basis. Scheduling includes the very important task of prior-planning a maintenance program to prevent operational failures that might otherwise occur during the coming year. Scheduled preventative maintenance may be coordinated with any number of interconnected operating companies. The off-peak months of the year usually offer ample opportunity for all major repairs to be completed. Continued operation depends on a sound maintenance policy; however, the schedule should never permit system reserves to be unduly taxed by allowing too much capacity to be shut down at any one time. Successful operation with adequate reserves is the direct result of a staggered maintenance program coordinated throughout the interconnected system. One solution to this particular operation problem is outlined herein and is called the "Percent Mw—Percent Mwhr" method of allocating system loading to generating stations.

The "load-duration" curve, previously referred to in Fig 1, is a familiar representation of the number of hours each year a particular megawatt-hour output was drawn from the systems power plants, in other words, the number of hours "duration" of a particular output value. The "load-duration" curve of Fig 1 is used as the basis from which the "Percent Mw—Percent Mwhr" curve is derived for a simplified means of explaining the method. Actually, a curve of this type is used only when tabulated data are not available. Data for the "Percent Mw—Percent Mwhr" curve is generally compiled daily from the load records. It is necessary to determine from log sheets or daily load curves the recurrences of loads of each magnitude. These recurrences are then accumulated to determine the number of hours each particular load occurred. From such data a normal "load-duration" curve may be drawn. If the number of hours each load occurred is then multiplied by the megawatt value and accumulated, the resulting data will give the amount of energy required for a certain period of time. Expressing the megawatts and megawatt-hours in percent then produces data for the "Percent Mw—Percent Mwhr" curve. Many prefer to use the tabulated data rather than converting it to curve form.

Since the "load duration" curve is plotted in megawatts vs hours, the product of which is megawatt-hours, the area under the curve is equal to the total Mwhr output for one year. Therefore, by graphic integration, the Mwhr output for any given number of hours may be calculated.

Integrating the "load-duration" curve, Fig 1

Summation of load in peak area = 32.24×10^5 Mwhr.

Summation of load in base area = 8.76×10^5 Mwhr.

Peak output = 32.24×10^5 Mwhr.

Base output = 8.76×10^5 Mwhr.

Total output 41.00×10^5 Mwhr.

Thus by graphic integration the total output for the system is 4,100,000 Mwhr for one year.

Data for the "Percent Mw—Percent Mwhr" curve is tabulated in Table 1. The column headed *Mwhr x 10^5 in Base* is calculated by successive integration of the 100 Mw strips in the "load-duration" curve

TABLE I—Main Curve Data

% Mw Capacity in Base	Mw in Base	(1) Mwhr $\times 10^5$ in Base	(2) % Mwhr in Base
0	0	0	0
10	100	8.76	21.3
20	200	17.26	42.2
30	300	24.86	60.0
40	400	30.06	74.6
50	500	34.56	84.4
60	600	37.66	92.0
70	700	39.26	95.8
80	800	40.26	98.5
90	900	40.76	99.5
100	1,000	41.00	100.0

(1) Calculated from "Load-Duration" curve by graphic integration
(2) % of total Mwhr (41 $\times 10^5$ Mwhr)

TABLE II—Vernier Curve Data

% Mw Capacity	% Mwhr in Base Vernier Scale
58	90.0
60	92.0
70	95.8
80	98.5
90	99.5
100	100.0

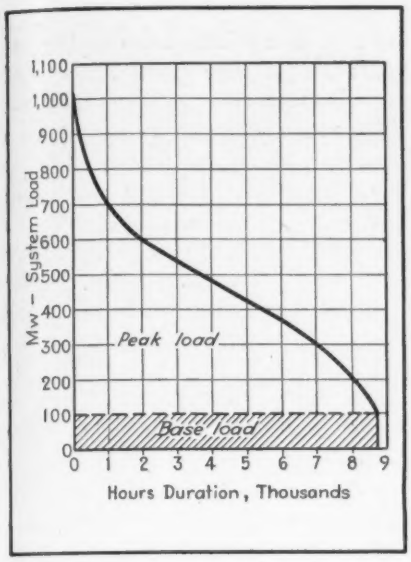


FIG 1—LOAD DURATION curve for the theoretical system indicates clearly the number of hours each year a given capacity must be available to serve the system load

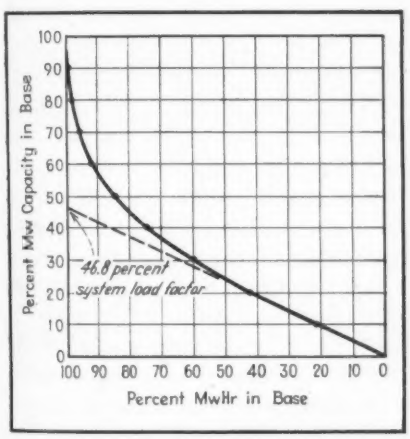

Percent Mw Capacity in Base
100 90 80 70 60 50 40 30 20 10 0
46.8 percent
system load factor
100 90 80 70 60 50 40 30 20 10 0
Percent MwHr in Base

FIG 2—MAIN CURVE of the technique is the Percent Mw—Percent Mwhr curve which considers percentage in base or peak sections of load curve and its effect on capacity

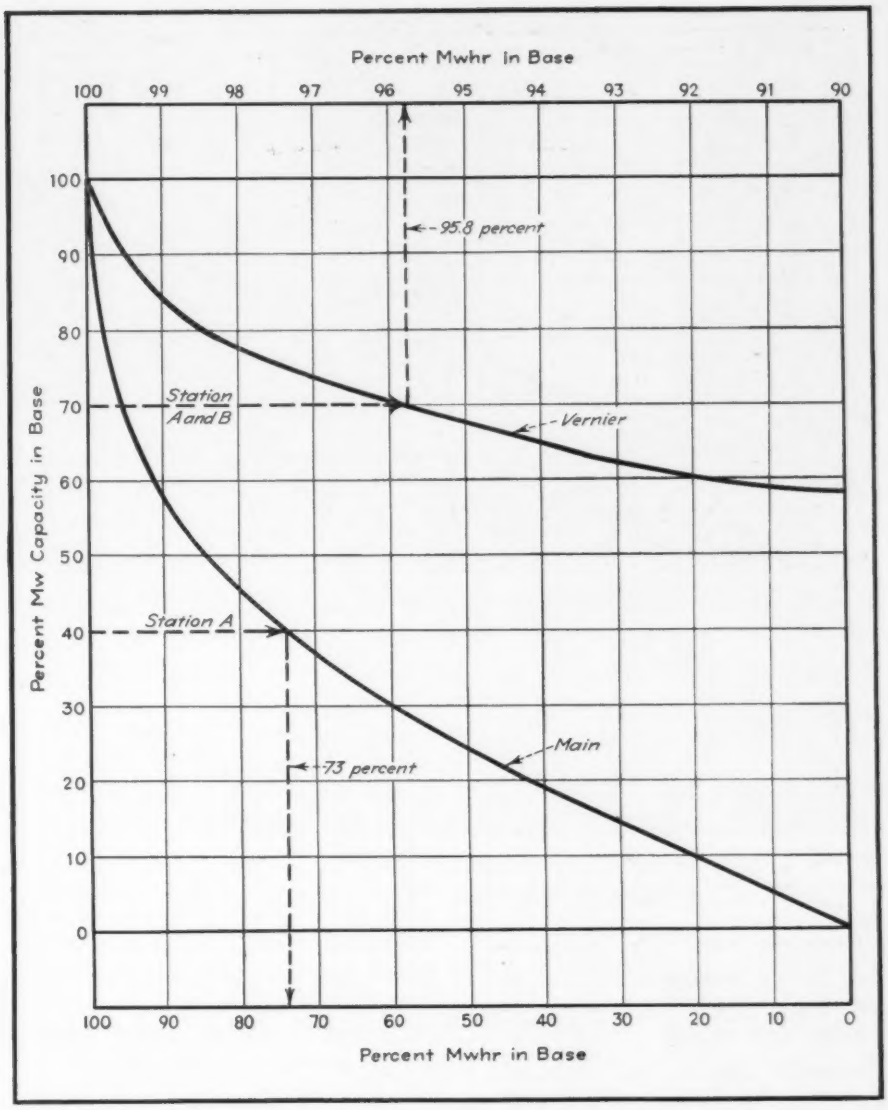

Percent Mwhr In Base
100 99 98 97 96 95 94 93 92 91 90
95.8 percent
Station A and B
Vernier
Station A
73 percent
Main
Percent Mw Capacity in Base
100 90 80 70 60 50 40 30 20 10 0
100 90 80 70 60 50 40 30 20 10 0
Percent Mwhr in Base

FIG 3—VERNIER CURVE with scale expanded 10 times larger than main curve allows accurate reading to end of scale

corresponding to the Mw values tabulated in the adjoining column.

The plotted data of Table 1 is shown in Fig 2 and comprises the main curve of the method. Since the curve rises rather sharply toward the higher end of the *Percent Mwhr in Base* scale it is desirable to reproduce this portion of the curve at a larger scale. To make a curve that can be read accurately the data shown in Table II is taken from the main curve and is replotted to a scale expanded ten times and run along the top of the curve sheet. This vernier curve gives accurate results to the end of the scale. The two curves, main and vernier, are combined on the same sheet in Fig 3 and complete the picture of a "Percent Mw—Percent Mwhr" curve capable of giving a full range of accurate results.

Attention is called to the fact that the extension of the straight portion of the curve intersects the lefthand Mw scale at a value which is the system's load factor. This can be readily seen by assuming that the entire megawatt-hours are at 100% load factor. The megawatts necessary to produce these megawatt-hours in the given number of hours time will be the same as the system load factor when expressed in percent of the actual megawatt peak load.

$$\text{Load factor} = \frac{\text{Mwhr}}{\text{Mw}(8760)} = \underset{\text{(assumed)}}{100\%}$$

Then the Mw necessary at 100% load factor is,

$$\text{Mw} = \frac{\text{Mwhr}}{\text{L.F.}(8760)} = \frac{4,100\ 000}{100(8760)} = 0.468 \text{ or } 46.8\%$$

Failure of the load factor line to cut this point indicates an error in development or calculations. It is a check that should always be applied. In the example used, the load factor line leaves the curve at about 18% Mw capacity in the base. When reading the system load factor from a curve of this type, a straight edge should be lined up on the first 20% of the curve for best results.

As previously stated, the "Percent Mw—Percent Mwhr" curve is used to allocate load to the various generating stations of the connected system. For the purpose of carrying out the example used thus far, the same system shown on the "load-duration" curve of Fig 1 will be used with the assumption that four power plants, A, B, C and D, supply the system output. In the interest of clarity, over-simplification has been

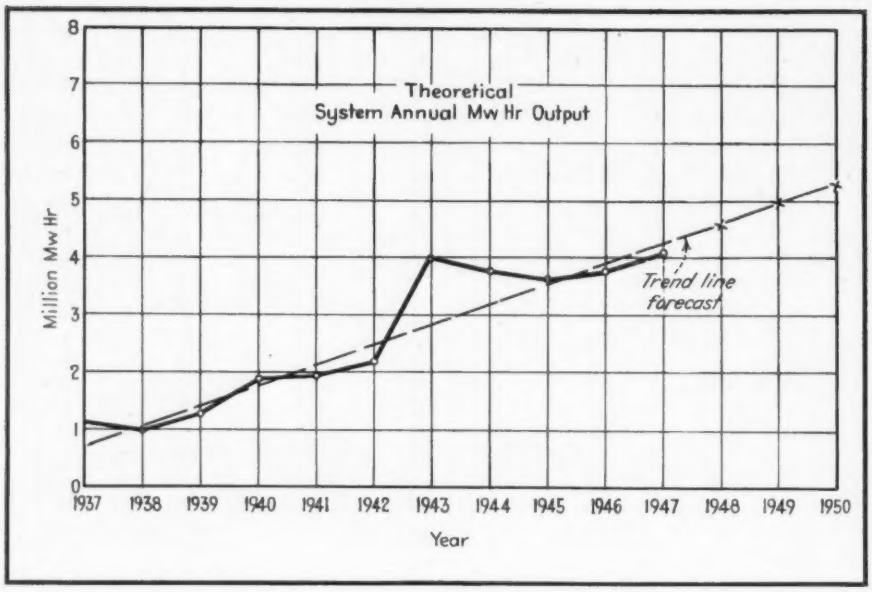


FIG 4—DATE AND DATA from output trend line are basic information necessary for applying the technique

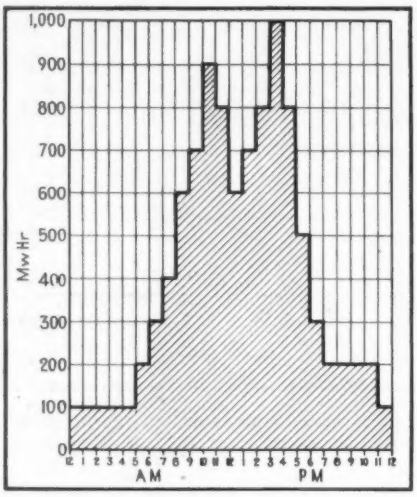


FIG. 5—COMPILED DATA from daily load curves produce duration curve shown in Fig I

used. The actual plants probably would be composed of units of various sizes, ages and efficiencies. For most economic operation, it would be necessary to schedule the units in the order of their individual efficiencies instead of total plants. Allowances should be made also for scheduled maintenance of each unit, particularly those carrying the base load. The most efficient plant in the system should carry the greatest portion of the base load, but all plants must be assigned a portion of the base load which is high enough to permit them to operate with reasonable efficiency. This method quickly and easily gives an approximation that is generally closer than an actual schedule can be held. A simplified example of the application of the "Percent Mw—Percent Mwhr" curve to a system is given in Table III.

This method of tabulation as applied in Table III on the 1947 output may be carried out for a number of years ahead by forecasting the total annual system requirements. Although the "load-duration" curve is compiled from data of a previous year, the function of the "Percent Mw—Percent Mwhr" curve is current and is of great value in forecasting station requirements a number of years ahead. The general shape of the "load-duration" curve does not change materially from year to year; therefore, the "Percent Mw—Percent Mwhr" curve will have the same characteristic shape, and the results obtained from it are very reliable for forecasting load allocations. Graphs similar to the one shown in Fig 4 are an excellent basis for estimating future trends. From the trend line, it would appear that the total output for 1948 is approximately 4,600,000 Mwhr. Load allocation may then be scheduled in advance with considerable accuracy by assuming the normal load growth for the system. Then, by the prescheduling of load to plants, it is possible to work out maintenance and repair periods on each machine and at the same time, be assured of adequate capacity to supply the system's load.

Sample Determination

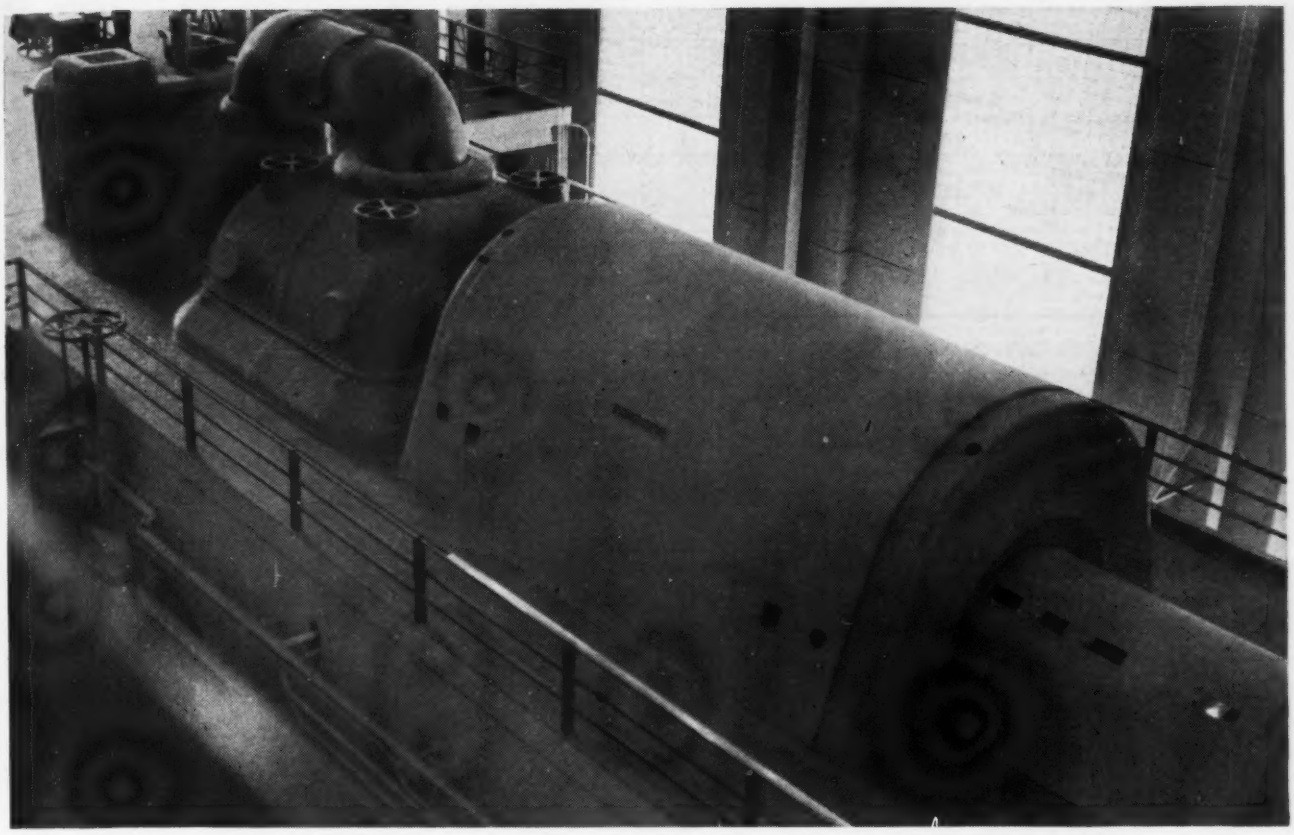
The technique is simple to use. Referring to the example given in Table 3, it is seen that station A is capable of continuously supplying 400 Mw to the system. This is 40% of the system's capacity. From the Main curve in Fig. III, it is noted that this 40% of the capacity as exists in station A will supply 73% of the Mwhr. This 73% of the total system requirement is equal to 3,000,000 Mwhr. (0.73 × 4,100,000).

To determine the load to be assigned to station D, the same technique is followed through, except that the aggregate capacity of the two stations are used and the necessary subtractions follow later. From Table III it is noted that stations A and B with a total capacity of 700 Mw constitutes 70% of the total capacity. Again by referring to Fig 3 it is noted that the total output of these two stations constitute 95.8% of the Mwhr. It is noted also that in this instance the vernier curve is used, since the slope on the main curve at 70% is so great. This total of 95.8% of the total 4,100,000 Mwhr required is 3,930,000. By subtracting the load already allocated to station A from this figure, it is found that station B will be scheduled to supply 930,000 Mwhr. The table of allocated loads to individual stations is completed by subtracting allocated loads from subsequently larger load percentages.

TABLE III—Example Problem

1—Assume the "load-duration" curve of Fig 1 is for 1947.
2—The system peak load is 1,000 Mw.
3—The system output is 4,100,000 Mw.
4—The system is supplied by 4 power plants: A, B, C and D with rated capacities of 400, 300, 200 and 100 Mw respectively.

(1) Station Capacity Mw	(2) Station Name	(3) System Mw	(4) Total % Mw	(5) Total % Mwhr	(6) Mwhr Total	Mwhr Allocated Station Load A	B	C	D
400	A	400	40	73.0	3,000,000	3,000,000			
300	B	700	70	95.8	3,930,000		930,000		
200	C	900	90	99.5	4,080,000			150,000	
100	D	1000	100	100.0	4,100,000				20,000



STANDARD TURBINE GENERATOR rated 60,000 kw and installed at Redondo Beach Station of the Southern California Edison Co is said to be the first AIEE-ASME standard machine of this rating

Today's Trend in Turbo-Generator Design

Growing acceptance of 3,600 rpm turbo-generators for all but the largest capacity installations is focussing the attention of designers and operators on higher hydrogen pressures, problems of double frequency vibration, higher generator and exciter voltages and new excitation systems

C. M. LAFFOON
Manager, A-C Generator Engineering
Westinghouse Electric Corp
East Pittsburgh, Pa

GROWTH in the size of 3,600-rpm turbo-generators today has in effect driven slower-speed, four-pole generators from the central stations field for all but the largest capacity installations. Even here, large 3,600-rpm units are beginning to appear. In part accountable for this is the trend to higher steam pressures and temperatures which has brought with it a reduction in physical size of units and made 3,600-rpm machines more desirable. Better rotor forgings, too, have been another big factor boosting the capacity of units that can be built for 3,600 rpm.

This growth in rating of 3,600-rpm machines points up the importance of several recent developments in the design and construction of modern turbo generators. These design trends include:—(1) A movement toward higher hydrogen pressures; (2) Efforts to improve hydrogen sealing glands and eliminate sealing oil conditioning equipment; (3) The need for higher generator and excitation voltages; (4) Growing acceptance of electronic and other forms of excitation; (5) Solutions to problems imposed by double-frequency vibration; (6) Growing use of cold-worked alloy copper rotor windings to eliminate plastic deformation under high compressive stresses and (7) Acceptance to date of the joint AIEE-ASME turbo-generator standards.

Hydrogen cooling of turbo-generators has met all of the anticipated results to date. It has increased output per unit of material, reduced windage

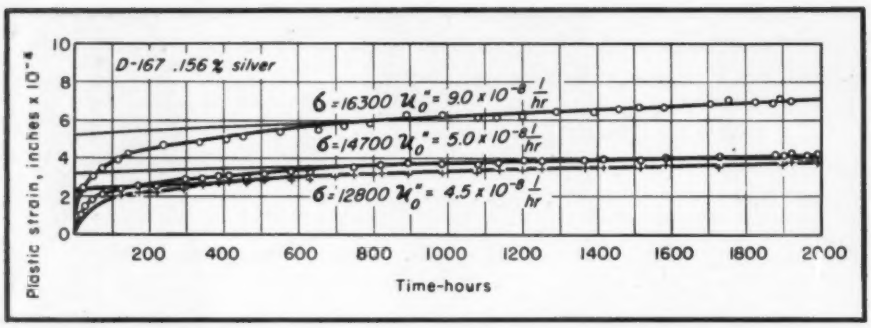


FIG 1—COLD-WORKED COPPER with a small percentage of silver has very little creep under thermal cycling that might cause insulation failure in generator field windings. Here plastic strain of silver-alloyed copper is plotted against time for stresses of 12,800, 14,700 and 16,300 psi

and ventilation losses, while at the same time cutting maintenance and outage time and costs.

During the past several years, it has been Westinghouse practice to design hydrogen-cooled turbine generators for operation at gas pressures of 0.5 to 15 psi (gauge). Operating experience has confirmed, that by increasing gas pressure from 0 psi to 15 psi, generator output can be increased 1% for each pound increase in pressure without exceeding the temperature rise guarantees at atmospheric pressure.

Above 15 psi the increase in output is less than 1% per pound increase in pressure. Over a range of 15 to 30 psi, approximately 2/3 of 1% increase in output per pound increase in pressure is expected. Actual operation at the higher pressures will be required to confirm this value. All percent increases in output are considered to be based on 100% rating at 0.5 psi gas pressure.

In practically all states, there are codes and insurance regulations covering the design, materials, workmanship and pressure tests for "Unfired Pressure Vessels." In many state codes the ASME code covering "Unfired Pressure Vessels" is used as the reference guide. A vessel having a gas volume greater than 7.5 cu ft and an operating pressure greater than 15 psi falls in the class of an "Unfired Pressure Vessel," if it is interpreted to be used in that sense. The design, materials, and workmanship must conform to the applicable code requirements and be approved by authorized state and insurance inspectors. The final structure must be hydrostatically tested, each piece of material must be stamped with the material specification number and a name plate provided which gives the hydrostatic test pressure, and the maximum operating pressure. Thereafter annual inspection and hydrostatic tests are required.

At present there is a wide variation in the code requirements for different states. Whether or not the housing of a hydrogen cooled rotating machine falls in the class of an "Unfired Pressure Vessel" has not been conclusively answered. Interpretations of a small number of states and insurance company representatives is that the housing is a machine part and outside the scope of the "Unfired Pressure Vessel" code. All agencies checked to date, however, agree that at present it is the responsibility of the manufacturer and the purchaser to see that the equipment meets the same end results as required by "Unfired Pressure Vessel" codes.

It is our conclusion that rotating machines that are to be operated at hydrogen pressures greater than 15 psi should be designed, built and hydrostatically-tested in conformity with codes covering "Unfired Pressure Vessels" of the state where the equipment is to be used. Under this procedure the manufacturer will not be required to stamp the material specification number on the pieces used to fabricate the housing, nor would the user be required to have the machine inspected and hydrostatically tested annually if it is adequately protected against rusting. A special plate would be provided which would give the initial hydrostatic test pressure and the maximum operating pressure.

In view of the recent interest in operating large hydrogen-cooled turbine generators at pressures greater than 15 psi under emergency situations an investigation has been made of our machines for non-standard ratings of 60,000 kw and above. This investigation shows that all such machines now on order can be built to be satisfactory for operation at 30 psi gas pressure. At 30 psi it is expected that the output will be 25% greater than at 0.5 psi pressure. Gas consumption may be appreciably higher than the expected value for operation at 15 psi pressure.

Since the stator and rotor windings and stator core respond differently to the ventilation at the higher gas pressures, actual temperature conditions are somewhat unbalanced at the higher pressures. For the largest ratings, it is proposed to design the unit for maximum rating at the highest practical pressure, and specify the ratings for the lower gas pressures.

Performance of auxiliary equipment for conditioning oil supplied to hydrogen sealing glands and for drying the gas has been satisfactory at the lower gas pressures. Hydrogen sealing glands that require no oil-conditioning equipment are being studied as a way to reduce maintenance. Experimental work and operating experience so far indicate that sealing gland oil conditioning equipment can be dispensed with for smaller 0.5 psi hydrogen-cooled units. But, an increase in the amount of gas make up required is expected. Generally speaking, lower gas consumption with present types of sealing glands can only be obtained by reducing the amount of oil supplied to seals. Reduced oil flow calls for reducing the clearances between stationary and rotating parts of the seal. This introduces the hazard of shaft rubs that could result in shaft bending and vibration. Elimination of the auxiliary oil-treating equipment should not be obtained at too great a sacrifice in generator reliability.

Higher Generator Voltages

For the largest 3,600-rpm machines, two departures will probably be made in the voltage of stator and rotor windings. Because of the limitation in the current carrying capacity of the main lead terminals, the most economical voltage should be used for each rating. This is the voltage that would result from the use of single-turn half-coils with the winding wye-connected in two parallel or two-

winding circuits. It lies between 13,800 and 18,000 v terminal to terminal. Excitation voltage should be kept between 375 and 500 v to reduce the magnitude of the excitation current handled by the collector rings and the exciter. Two 81,250 kva, 3,600-rpm generators are now being built for a 375-v excitation.

New Excitation Systems

Some recent 3,600-rpm generators now in service and under construction have direct-coupled 3,600-rpm main and pilot exciters. A few are being built without direct-connected exciters, but will use either 1,200-rpm motor-driven exciter sets or electronic excitation. One such electronic excitation system is in use at the Springdale Station of the West Penn Power Co and is performing satisfactorily. Two generator units are being built with electronic excitation systems in which the electric power is supplied to the electronic equipment by direct-driven, six-phase auxiliary generators. While acceptable performance of these electronic excitation systems is anticipated, the ease of servicing direct-connected exciters may hold operator approval of known and tried excitation means. Initial cost of electronic excitation is much higher than direct coupled or motor-generator exciters.

Double-Frequency Vibration

A two-pole 3,600-rpm turbo-generator has a number of inherent characteristics not present in an 1,800-rpm generator.

1. Double frequency stator core vibration
2. Double frequency rotor vibration
3. Increased thermal expansion and contraction forces on field winding conductors resulting from operation at higher rotor peripheral speeds.

Double-frequency vibration was encountered on 15,000-kw and 1,800-kw, 3,600-rpm generators from 1925 to 1930 but it was not realized that its effects would be pronounced for larger ratings.

Double-frequency vibration of the stator core is inherent in a two-pole generator. Its magnitude can be cut by reducing the loading of the magnetic circuit, or by making the stator core more rigid against distortion from radially-applied forces, or both. By fixing the magnetic loading and mounting the stator core winding and other core components flexibly in the generator housing, the core is free to respond to the rotating distorting forces as a solid cylinder without transmitting the vibrations to the housing foundations and other stationary parts. Flexible mounting of a large two-pole generator that required an inner frame on account of shipping clearances is shown in the accompanying picture. This construction reduced the magnitude of double-frequency vibrations to negligible values.

Double frequency vibration of a two-pole rotor results from differences in mechanical rigidities along the rotor's two major axes; one axis through the pole center and the other through the winding center. By machining cross-slots in the rotor poles, rigidities on the two axes are equalized and the double-frequency vibration is eliminated. This accomplishes the desired result without removing an appreciable amount of magnetic material from the rotor pole body.

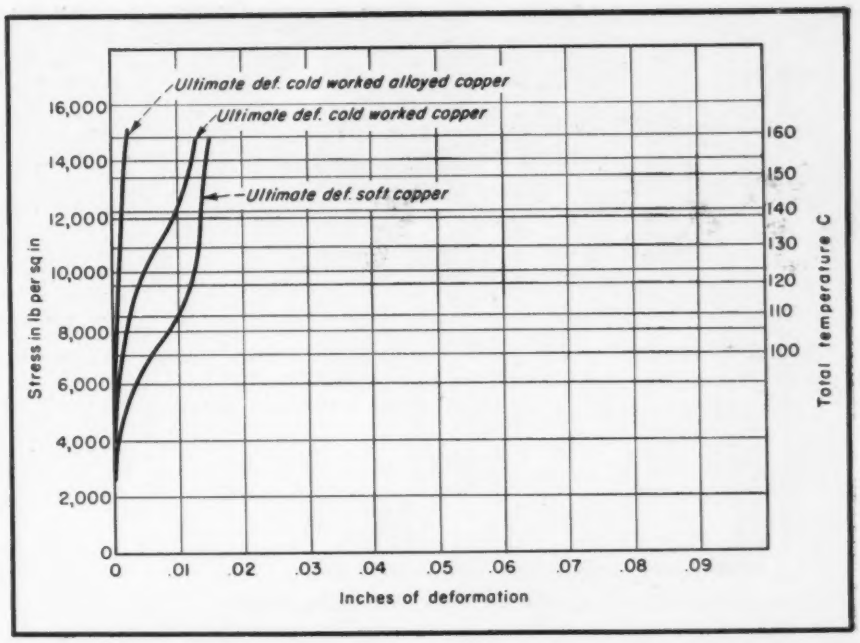


FIG 2—ULTIMATE DEFORMATION of cold-worked silver alloyed copper is less than total strain of either cold-worked unalloyed copper or soft copper under the same conditions. Here creep is plotted against stress for three kinds of copper at 150 C; all ten years old

Alloy Rotor Windings

Use of special cold worked copper alloys for rotor windings has reduced plastic deformation of conductors and the subsequent failures in high-speed machines. When a generator is brought up to speed its rotor coils are forced against supporting wedges and retaining rings by centrifugal forces. When the field current required by load is applied, the field copper tends to expand more than the surrounding iron and supporting wedges because of its higher temperature and thermal expansion coefficient. The copper is locked in position for a major portion of the length of the field coils by high frictional forces that resist slippage. These compressive forces result in deformation. Plastic deformation prevents the coils from returning to their original length when the machine is unloaded and stopped. Consequently, as the number of temperature cycles increase there is an increasing amount of shortening. Failure occurs eventually due to grounds or short circuits in the end turns.

Cold-worked copper while less ductile than annealed copper yields plastically under prolonged stress loading. Its creep rates with different alloying elements are shown in Fig. 1. Cold-worked silver alloy copper has been used for the field coils of turbo-generator rotors for the past six years. The expected reduction in permanent deformation of field coils when cold-worked silver alloy copper is used instead of annealed copper is shown in Fig. 2.

About three years have elapsed since the joint AIEE-ASME standard line of large 3,600-rpm turbo-genera-

(*Continued on page* 153)

FAULT LOCATION is read directly from calibrated dial on oscilloscope

Pulse Radar Used To Locate Faults

Short-circuits, open-circuits, or grounds on transmission lines are located quickly by measuring the time it takes for d-c pulses to be reflected

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USING pulse radar methods for measuring distance, Puget Sound Power & Light Company quickly located faults which caused transmission line outages. The new device used is a combination high voltage pulse generator and synchronized oscilloscope receiver which gives direct visual indication of abrupt impedance changes on a line. (See also article on opposite page). Such changes may be caused by open circuits, short circuits or variations in line configuration.

Puget Sound Power & Light Company first tested such a unit over a year ago. It could be connected directly to the isolated de-energized line to be tested, but safey codes usually prohibit any direct contacts to high-tension lines unless grounded. For isolation, coupling capacitors of 0.1 mf at 20 kv with adequate spark gaps are used from phase to ground. Drainage coils for 60-cycle residual are put in parallel across the input terminals.

In operation the unit continuously generates sharp d-c pulses of five μ-sec duration at 1,000 v. Abrupt changes in line impedance cause a reflection of this signal. Time lapse between signal impulse and return is measured and shown on a calibrated scale of a cathode ray tube self-contained in the instrument.

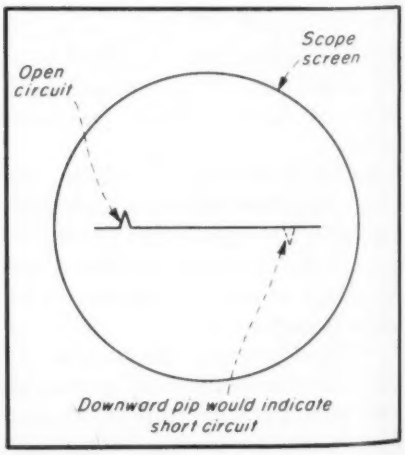
Tests clearly demonstrated the ability of the instrument to locate short circuits, open circuits, and even changes in conductor size, points of transposition and marked changes in line spacing. In one case, where the line was open-circuited 50 miles from the instrument, an open circuit 18 miles farther away showed up clearly. Capacity across the open switches passed enough signal to give a clear indication of the open circuit.

Polarity Shows Kind of Fault

Nature of the change in impedance is shown by polarity of the returning signal. Open circuits or increases in line spacing are shown by a positive trace or pip above the base line on the viewing screen. Short circuits, decreases in line spacing, or other abrupt decreases in line impedance, are shown by a trace below the line. The exact distance, on a given scale of miles, is shown along the horizontal line from the starting dot to each vertical pip of interest.

To locate the fault accurately, a marker pip can be moved across the screen until it coincides exactly with the incoming signal. Position of the fault is then read directly by position of the controlling dial on a scale calibrated in miles as a vernier check on the calibrated cathode ray screen. When the fault has been determined with full-scale accuracy on a range of 1, 5, 25, 50 or 100 miles, the section in which the fault is located can be examined more closely for greater accuracy. As an example, the controls may be set to examine the line for five miles beyond the 70-mile point. Full scale will then correspond to the section from 70 to 75 miles from the instrument. Accuracy of the instrument is affected very little by minor variations in speed of propagation of an electrical wave on various types of line construction. Suitable correc-

(*Continued on page* 91)



POLARITY of the reflected wave shows nature of fault

Improved Surge-Reflection System Locates Cable Faults

Cable fault finder operates by: Using periodic half-second pulses of d-c to arc-over the fault; (2) superimposing 3,000-v surges on the line 30 times per sec; (3) spotting the change in an oscilloscope trace between reflected surges when d-c pulse is on and off; and (4) orienting position of change on the trace on calibrated map

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A NEWLY DEVISED method, for locating faults on almost any type of line, operates on the radar principle, is relatively inexpensive to construct, and requires little power. Although still in development stage, as explained and discussed at the recent SEE meeting at Asheville, general results from its use in New Orleans have been excellent.

When a surge is applied to a transmission line it travels down the line until it meets a change in the characteristic of the line, either an open-circuit, a short-circuit, or any other change in the Z_o (surge impedance) of the line, and is then reflected. By applying small surges of about 3,000 v to the line, the time elapsing between the initial surge and correct reflection as read from an oscilloscope is correlated with cable length. A block diagram of the testing scheme is shown in Fig 1. Calibration for a typical underground feeder is shown in Fig 2. The complete wave obtained from applying the pulse to this feeder is shown in Fig 3 (A).

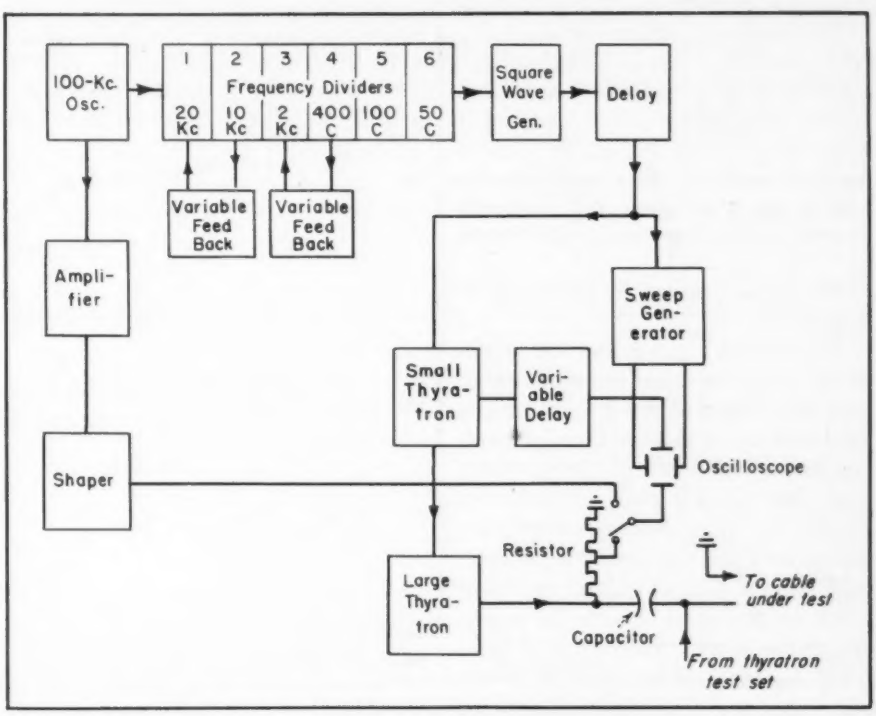


FIG 1—BLOCK DIAGRAM of newly developed type of cable fault finder

Surge Generator

The basis of the whole apparatus is the 100-kc oscillator. This is crystal-controlled so timing circuits are accurate. The output of the oscillator is fed through six frequency dividers; this output triggers a square wave generator, cutting the frequency to 30 cps. The leading edge of the square wave goes through a fixed delay circuit, and then triggers the sweep. It also fires a small thyratron, through which a condenser discharges. The wave produced by this thyratron fires a larger thyratron, discharging a previously charged condenser and producing a 3,000 v pulse.

No attempt is made to shape the pulse, but rather the exponential decay of a condenser discharged across a resistor is used. Various sized condensers can be switched into the circuit to give several different time constants. This is valuable, for with a short time constant, reflections will be obtained from many discontinuities, whereas, with a long time constant, only the relatively major discontinuities will show on the screen.

The cable under test, where the pulse is applied, is connected through a voltage divider to one of the vertical plates. Thus the initial pulse and the reflections appear on the trace. The output of a variable time delay circuit, triggered by the same pulse that triggers the sweep, is applied to the other vertical plate. This puts a step in the sweep, which can be positioned to any of the reflections appearing along the sweep. The step is

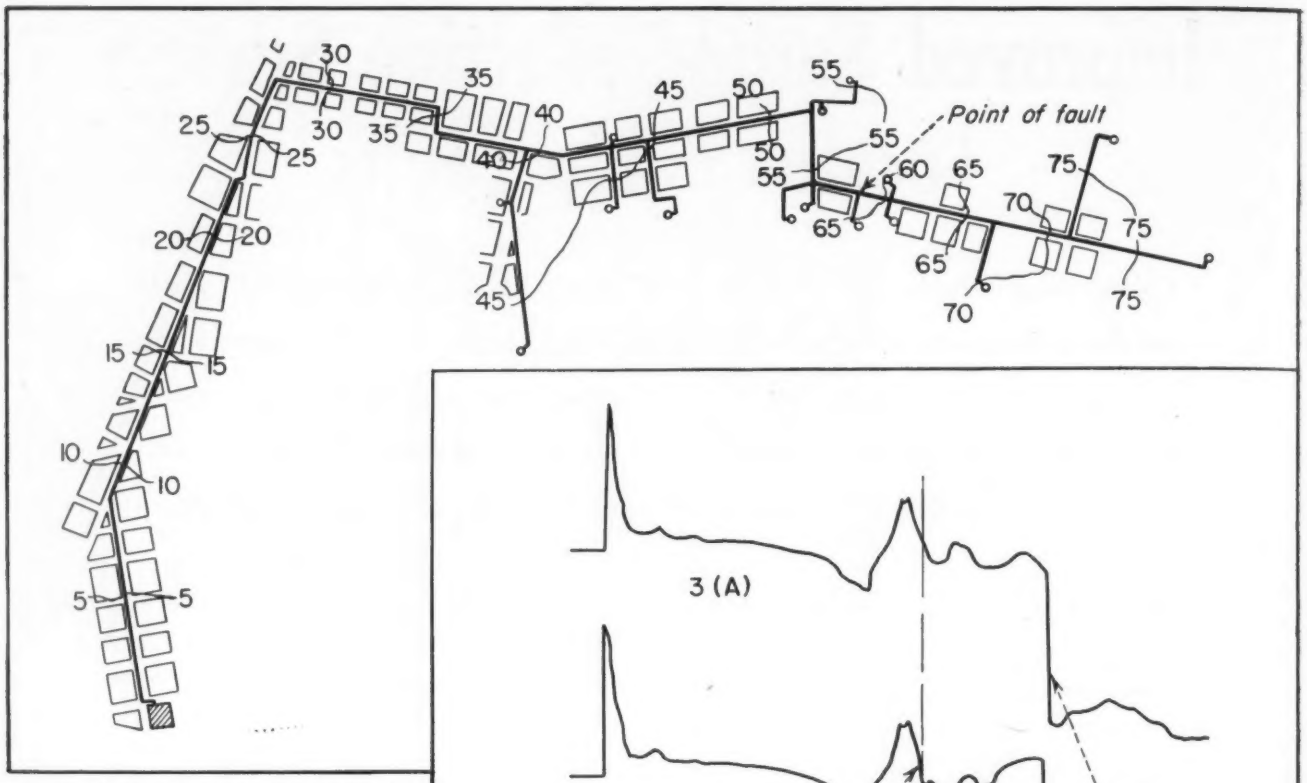


FIG. 2—MAP of typical feeder calibrated in microseconds shows where fault is located

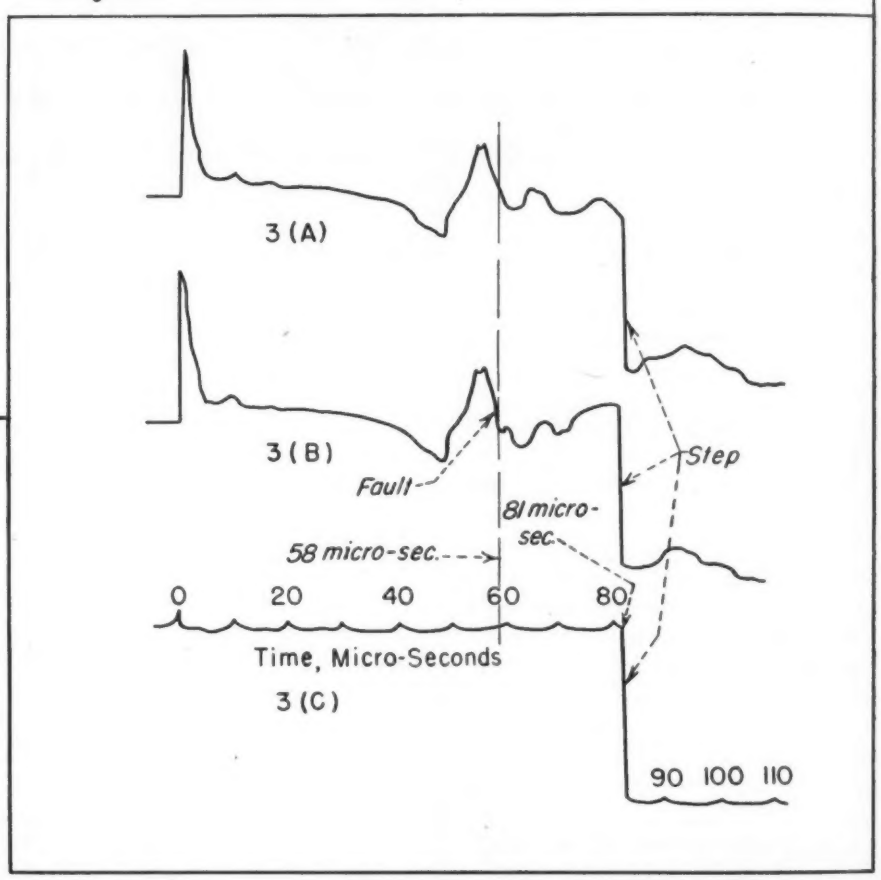


FIG 3—TYPICAL traces on oscilloscope . . . (A) Feeder in Fig 2 in operating condition. (B) Same feeder in faulted condition. (C) Timing marker pips every 10 micro-seconds

shown positioned at 81 micro-sec in Fig 3.

The original pulse and the reflections can be switched from the sweep and the output of the 100-kc oscillator, after being amplified and shaped, applied to the vertical plates, along with the variable step, as shown in Fig 3(C). Thus, markers exactly ten micro-sec apart appear on the screen, and it is a simple matter to count them to the step. Since the sweep triggering is controlled by the 100-kc oscillator through frequency dividers, the pips are stationary along the sweep.

It takes about 20 micro-sec for a wave to travel down and back over a mile of cable. Therefore, the distance between two of the pips represents about a half-mile. With this scheme it is easy to estimate (cable faults) to one micro-second or 1/20 of a mile, about 265 feet. Tests showed that the pulse travels about 220 ft per micro-second as measured along the surface of the ground, that is, without taking into consideration the cable racked in manholes.

In using this apparatus, it is only necessary to (1) find a new reflection, (one that did not appear when the cable was in operating condition), (2) position the step to this reflection, (3) turn one switch and (4) count off the number of micro-seconds to the step (and consequently to the fault). Using a map of the feeder previously calibrated in micro-seconds, the approximate location of the fault can be found immediately if the cable is a transmission feeder. If a distribution feeder, such as a network feeder, the fault can be placed within about three locations.

D-C Arcs Over Fault

Of course, one basic difficulty is to insure that the fault gives a clear change in the trace so it can be spotted. For one thing, a fault on a cable is rarely a dead short. A fault with low voltage applied may measure 5,000 or 10,000 ohms, even though well carbonized. Since the surge impedance of a cable is about 60 ohms, 5,000 ohms across it, or even 500 ohms, does not change the characteristic at that point and so no reflection takes place. Only when a relatively high voltage is applied does the fault arc, and the "resistance" fall to zero. Voltages of about 4,000 to 6,000 d-c v are often required to start an arc through a carbonized fault in 13-kv cable. But sometimes even surges of 25 kv do not always arc across a similar fault.

To avoid the use of extremely high voltage and to facilitate detecting the

change in the reflected wave caused by a fault, the 3,000-v test surges are superimposed on half-second d-c pulses. The d-c pulses are produced by a thyratron set capable of delivering either ten kv at 0 amp or five amp at 0 v, there being 100% regulation. Normally, the trouble-shooter searching for the fault "picks up" this direct current in successive manholes along the cable, progressing until he no longer receives an indication. Superimposing the shorter three micro-sec pulses in no way interferes with the work, and d-c is still used to pin the fault down.

With the d-c pulse off, the trace on the screen is the same as if the cable were not faulted, since the resistance of the fault usually is much higher than the surge impedance of the cable. But when the d-c pulses are applied, the fault arcs over, its "resistance" goes to zero, and the pulses are reflected. Thus the trace is the same as if the cable were metallically shorted at that point. With the d-c pulses cycling on and off, a continuously alternating trace is seen on the screen. By adjusting the step in the trace to the first point along the trace where a change can be noticed (compare Fig 3(A) with 3(B)) and throwing a switch, the time in micro-seconds can be read as shown in Fig. 3(C). Although the step is shown at 81 micro-sec, in operation it would have been moved over to line up with the fault at about 58 micro-sec. Referring to a map of the circuit that was previously calibrated in micro-seconds, such as Fig 2, two or three points likely to be faulted can be determined. Thus, the length of line for the troubleshooter to test for the d-c signal is greatly reduced.

Still Experimental

Although still in the experimental stages, recognizable reflections have been obtained about 75% of the time. On a half dozen occasions the trouble-shooter opened but one manhole and found the fault. On several others he was directed about two or three manholes away, and once or twice was directed about two blocks from the fault. Also, each time there is a fault on the circuit and a reading is taken, another calibration point is secured for that feeder. Thus accuracy should improve. With experience, it also may be possible to tell in which major branch of a distribution feeder the fault is.

About one-fourth of the faults are not detected by the system because reflections only occur from faults with an impedance of less than or about the same as the surge impedance of the cable. But the cable arcs over as a result of the periodically applied d-c only when the fault is reasonably dry. If the fault is submerged in water, usually no arc can be maintained since the current flows through the water. Unfortunately, the resistance of the water may be considerably higher than the surge impedance of the cable, and no reflection occurs. Based on experience to date, a new pulse-forming circuit is being developed to obtain reflections from any type of fault.

Pulse Radar Used To Locate Faults

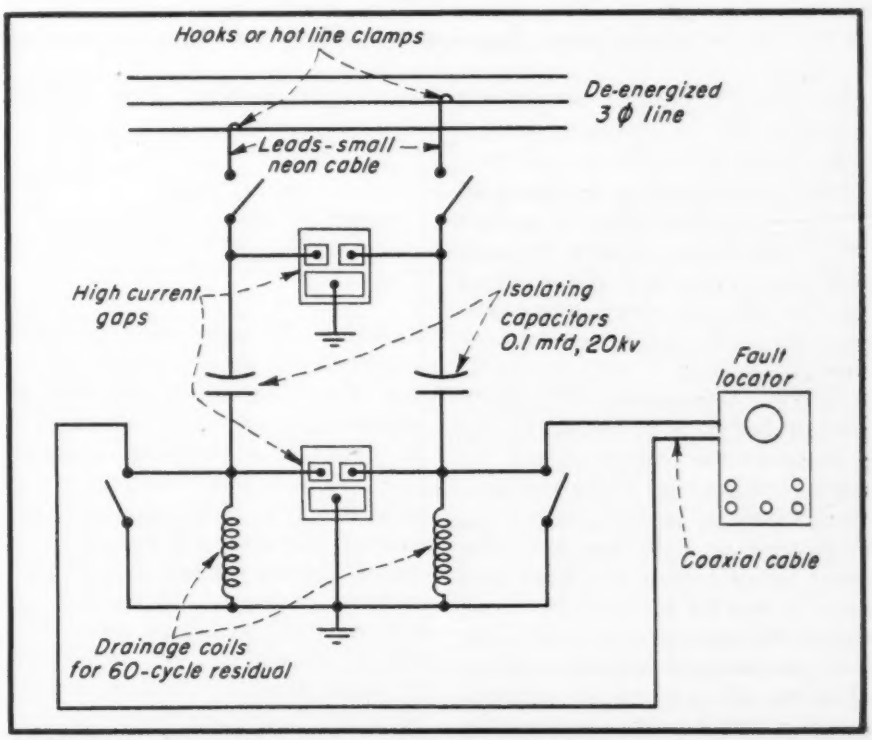
(*Continued from page* 88)

tions can be applied to scale readings using the known length of the line as a reference, or the instrument may be calibrated exactly for any given line.

Can Compare Reflections Directly

Simplest and most accurate method for an inexperienced operator to use the instrument will be by direct comparison. A positive transparency of the line in normal operation can be superimposed on the viewing screen. This will quickly locate any abnormal condition on the line.

The instrument as now used is portable. Pulse generating transmitter and synchronized oscilloscope receiver are all contained in a case almost the same size as a standard oscilloscope. Power supply of 115 v, 60 cycles, 75 w can be supplied by inverters on the company's line trucks. The unit has been tested and found well suited for locating faults on communication and power lines.



CONNECTION DIAGRAM for coupling fault locating device to de-energized line

The Radar Engineers of Seattle are developing a separate transmitter-receiver unit that can be used with a standard oscilloscope. This unit will give the small company already having an oscilloscope the equivalent service of the complete instrument at a smaller original investment.

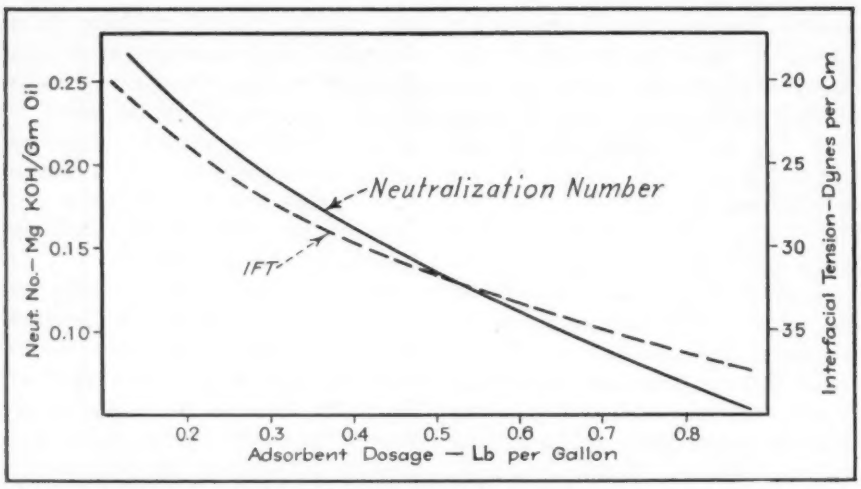


FIG 1—TREND OF NEUTRALIZATION NUMBER and interfacial tension values with increasing adsorbent dosage during oil conditioning run

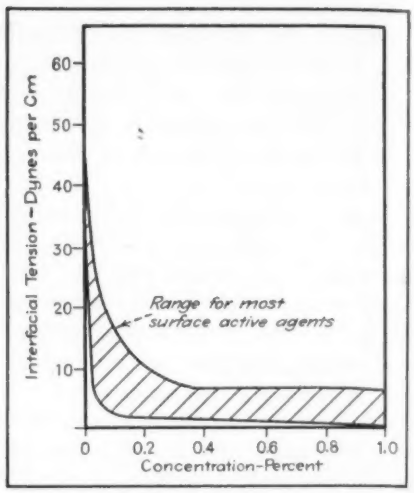


FIG 2—INTERFACIAL tension decreases with concentration of surface active agents

Factors Affecting the Cost Of Purifying Insulating Oil

Survey of 200 utilities shows wide range of cost for reconditioning insulating oils. Seldom exceeds 15¢ per gal. Author examines factors tending to cause excessive conditioning costs; suggests procedures that can effect more economy

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COST of conditioning insulating oil is largely determined by method of calculation. Labor, material and fixed costs are the essential charges. But not every utility relegates them all specifically to the reconditioning cost.

How cost figures vary is shown by a survey of some 200 utilities. Depending on the equipment and the manner of figuring costs, estimates ranged from as low as 1.4¢ per gal to as high as 15.5¢ per gal. The lower figure represented labor and material cost for conditioning an oil with the transformer under load. The 15.5¢ per gal figure included a charge of almost 5¢ per gal for crating, shipping and handling because the unit was shipped to a remote location and only a small volume of oil purified.

A typical analysis of the cost of insulating oil conditioning has been developed without any special allocation of specific cost items. It is a hypothetical case on the basis of typical data. This composite example (see box and data) from users of adsorbent type purification systems indicates that costs will generally not exceed 15¢ per gal and may be less in many instances. This seems to bear out the publicized contention that oil usually can be conditioned for about one-third the new oil cost when all charges are taken into account. In some cases, the accounting cost will be materially less since not all of the cost items may be charged to the oil-conditioning program.

While it is necessary to know the costs of oil conditiong, it is of equal importance to know the pitfalls that lead to excessive conditioning costs and procedures that can effect more economy.

Inefficient use of adsorbents is illustrated in Fig 1. It is an actual case where oil was continuously circulated from a transformer through an adsorbent purifier and blotter press. The conditioning was continued until the neutralization number was reduced to 0.06 and the interfacial value raised to 36.7 dynes. This required an adsorbent dosage of approximately 0.88 lb per gal. Yet, with an adsorbent dosage of 0.66 lb per gal, the neutralization number had been reduced to 0.10 and the interfacial tension value raised to 34.9 dynes. If acidity had been reduced to the 0.10-0.20 range, the interfacial tension value would have been about 30 dynes. The adsorbent requirement would have been only 0.45 lb, almost 50% less than actually employed. The

* Subsidiary of Houdaille-Hershey Corp

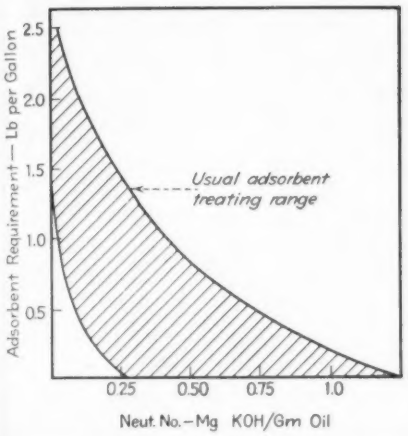


FIG 3—EFFECT of increased dosage of adsorbent upon neutralization number is shown together with usual adsorbent treating range

result is not only a doubled adsorbent cost but also a doubled oil loss.

The correlation between interfacial tension and concentration of surface active agents is hyperbolic. Actual correlation depends on the surface active agents involved. This is illustrated by the graph Fig 2. Minute quantities of surface active products (less than 0.5%) can reduce interfacial tension values from 50 dynes for a new oil to below 30 dynes. Thereafter, a considerable increase in oxidation products (only some of which are surface active constituents) will show correspondingly less change in the interfacial tension value.

Obviously then, in the final stage of adsorption we are dealing with minute quantities. Since the adsorption isotherm for clay or other adsorbents in also hyperbolic (See Fig 3 showing acid adsorption isotherm for natural clay), we can only remove such minute quantities by employing very high adsorbent dosages.

Little is to be gained by minute reductions at low levels since such quantities of oxidation products are likely to be formed soon after an oil is placed in service. The oil itself is really the controlling factor. If the natural oxidation-inhibiting constituents were not removed during refining, stability of the oil would not likely be affected by minute quantities of oxidation products. On the other hand, highly refined oil that does not contain natural inhibitors, but synthetic ones instead, would be more readily susceptible to the catalytic action of oxidation products once the synthetic anti-oxidants were exhausted. However, where this occurs, it matters little whether or not minute quantities of oxidation products are present because they will probably develop rapidly, judging from the results of accelerated oxidation tests.

Considerable adsorbent economy may be realized by employing two-stage treatment. It is particularly adapted to cases where it is desired to reduce the neutralization number to a very low level (below 0.10), at the same time raising the interfacial tension to almost the new oil value (40-50 dynes). The two-stage method is illustrated in Fig 4.

Conditioning is started using No. 1 purifier (Fig 4 Case I) and continued until equilibrium is reached. Oil is then directed through the No. 2 purifier, containing unused adsorbent, for the finishing step—removal of oxidation products at a low concentration level. When the next batch of oil is to be conditioned (Case II) the No. 2 purifier is used first and then No. 1 unit in which new adsorbent has been charged. Obviously, this procedure is simply the adaption of the old counter-flow principal to adsorption where the highest concentration of oxidation products is treated by adsorbent that has reached an adsorption equilibrium at a lower level on a previous run. Only new or unused adsorbent is employed for removing oxidation products at low levels. This can be extended to three or four stages if conditions warrant but operation becomes more complicated. Savings to be realized from two stage treatment are given below for a typical case:

Original Neut. No. 0.90 Final Neut. No. 0.17	Single Stage	Two Stage	Percent Saving
Pounds of adsorbent per gallon	1.78	1.36	23.6%

Use of a low-capacity purifier on a large volume of oil seems to be a prevalent practice. In some instances it cannot be avoided since too small a unit was purchased for the oil volumes in the system. For example, use of a purifier containing 100 lb of adsorbent on a transformer containing 700 gal of oil is unlikely to be an economical procedure. If adsorb-

Typical Analysis of Oil Conditioning Cost

Type of unit	Adsorbent purifier, portable, including blotter press, oven, pump and motor	
Flow	300 gph	
Equipment cost	$2,900	
Gallons conditioned per year	30,000	
Example Data:		
Transformer oil capacity		500 gal
Neutralization Number		0.50
Desired Neutralization Number		0.13
Adsorbent Required		0.91 lb/gal
Conditioning Time		4 hr
Distance from power garage		10 miles
Cost Analysis:		
	Cents per Gal	
(1) Fixed Cost		
Amortization (10 years)	0.93	
Taxes, insurance and interest	0.07	
		1.00
(2) Materials		
Adsorbent—455 lb at 4½¢/lb	4.10	
Purifier accessories	1.82	
Blotter paper	0.44	
		6.36
(3) Labor 6 hr at $1.75/hr		2.10
(4) Transportation 20 miles at 10¢/mile		0.40
(5) Power 10 kw at 2¢/kw		0.04
(6) Oil loss 10% (approx. depreciated value)		2.70
Sub-total (basis 500 gal)		12.6¢
Total cost of conditioning (basis 450 gal net purified oil)		14.0¢ gal

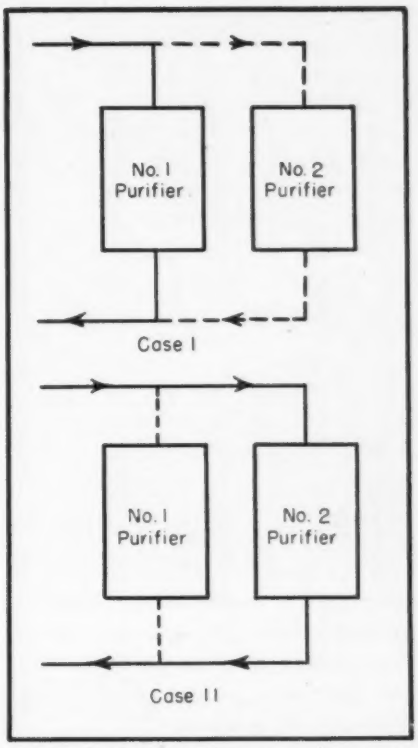


FIG 4—TWO-STAGE treatment of oil using two purifiers. In Case I batch is started on No. 1 purifier and run to equilibrium and then directed through the unused adsorbent of No. 2 purifier as a finishing step. The next oil batch to be conditioned is started on No. 2 (Case II) run to equilibrium and finished on No. 1 which has been recharged with adsorbent. Thus only new adsorbent is used for removing oxidation products at low levels

ent dosage was 1 lb per gal six refill changes would be needed and as much as 50 to 100 hr might be required for satisfactory conditioning. Labor costs would be excessive. It is not practical, of course, to purchase conditioning equipment that will be the optimum in size and capacity for the largest transformers without being oversize for the smaller units. Hence, a compromise is generally effected so that equipment is of optimum size and capacity for the range of oil volumes to be conditioned. Where the oil is conditioned at a central location, this problem does not arise.

Conditioning Oil In The Field

A number of utilities follow the practice of conditioning insulating oil in the field. The economy of such a procedure possibly warrants wider use, providing proper safety precautions are being taken.

It would appear advisable to remove units from service that are either known or thought to be sludged, so that after thorough conditioning the transformer can be inspected. After the oil has been satisfactorily conditioned, it may be advantageous in some cases to continue circulation through the purifier and transformer in order to obtain the benefit of sludge removal by the solvent action of the oil. This procedure has application only where a moderate sludging condition prevails, since the solvent power of the oil on sludge is limited. It is not a substitute for other forms of sludge removal when a substantial cleaning job is required.

Circuit-Breaker Oil

Although it has been customary to condition circuit-breaker oil in much the same manner as transformer oil, the problem involved is somewhat different. Sludging is, or may be, the principal problem in a transformer oil, where, aside from its dielectric service, the chief function is to dissipate heat. In a circuit breaker, on the other hand, the chief function of the insulating oil is to quench the arc. In so doing, thermal cracking can occur with formation of minute particles of carbon. These particles impair the dielectric strength of the oil and if present in sufficient quantity, will deposit on insulated surfaces so that a short circuit may ultimately result. While periodic conditioning of circuit-breaker oil is beneficial, the continuous conditioning of such oil would seem to be the most effective method of dealing with the variable situation attendant with circuit-breaker operation.

Evaluating Oil in Service

To decide when an oil needs to be conditioned, it is necessary to accurately evaluate the condition of the oil in service. The tendency has been to employ a single test such as neutralization number or interfacial tension for this purpose. In some cases, only the dielectric strength is checked and, if this is too low, the oil is filtered through a blotter press.

The use of a single test as a criterion is not advocated. While a number of chemical and physical tests would be desirable in the interest of better evaluation, it is realized that this is not always possible or practical. It is suggested that at least the following tests be employed to gauge the condition of the oil.

Neutralization Number
Interfacial tension
Dielectric strength
Power factor (%)
Sediment (naphtha insoluble)

Periodic sampling of oil in all units ought to be standard procedure. Analysis of oil every six months seems desirable on open-air type transformers, and possibly every year or two on conservator units. The initial quality of the oil should be taken into consideration in establishing sampling periods.

As a guide in setting up such a program and judging the average useful life of the particular oil, the data reported by Horsch (ELECTRICAL WORLD Aug. 31, 1946) should be helpful since it is based on actual tests on open-air transformer units. The testing procedure has been designated as a "simulated field service test."

On the basis of these tests, high-grade oils were shown to have a life of approximately six years before the neutralization number reached 1.0, the assumed end point of useful life on the basis of similar practices among many utilities. Low-grade oils, on the other hand, reach a neutralization number of 1.0 in $1\frac{1}{2}$ to $2\frac{1}{2}$ years. However, sludging may occur before this arbitrary end point is reached. The use of interfacial tension values as a guide to sludging tendency may be helpful along with the neutralization number value and such other tests as may be made. In any event, it is recommended that conditioning be instituted before a neutralization number of 1.0 is reached, especially if the interfacial tension value is 20 dynes or less.

Tables Omitted from Article

Referred to but missing from the article "How to Apply Transformers on Banked-Secondary Systems", that appeared on pages 81-85 of the October 23, 1948 issue of ELECTRICAL WORLD, were Tables I and II relating to the limiting distance between distribution transformers on banked secondary mains. These tables were inadvertently omitted from the article in preparing it for the printer and are inserted here for completeness.

TABLE I

Limiting Distance Between Identical Transformers Equally Spaced Along Secondary Mains

Based on 3% voltage drop in main and uniformly distributed load of 170% on each transformer 8 in. spacing between conductors

Wire Size	Distances in Feet for Different Transformer Ratings			
	10-Kva	15-Kva	25-Kva	37.5-Kva
#6	840	560	....	....
#4	1270	845	505	....
#3	1550	1035	620	415
#2	1880	1250	750	500
#1/0	....	1800	1080	720
#2/0	....	....	1355	905
#4/0	....	....	1790	1190

TABLE II

Limiting Distance Between Transformers To Hold Voltage Dip to 3 v On 120 v Base With 20 amp Abrupt Load

Based on equally spaced transformers, loop secondary bank, 8 in. spacing between conductors. Abrupt load applied midway between transformers.

Wire Size	Distances in Feet for Different Transformer Ratings			
	10-Kva	15-Kva	25-Kva	37.5-Kva
#6	450	550	650	710
#4	695	840	1000	1100
#3	850	1005	1230	1340
#2	1005	1280	1520	1640
#1/0	1480	1800	2120	2320
#2/0	1700	2005	2460	2700
#4/0	2140	2600	3100	3400

LAST YEAR'S Balanced Farming Banquet, sponsored by AP&L, was attended by more than 350 farmers and their wives

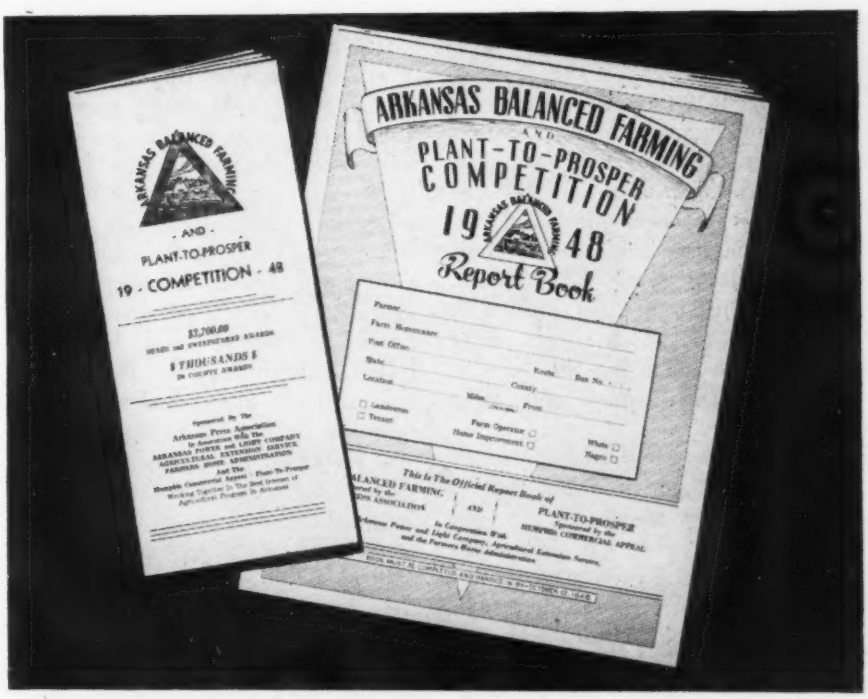
Power Company Sparks Better Farming Competitions

Prime mover part in agricultural improvement program is undertaken by utility

ROSS MAUNY
Director, Rural Development
Arkansas Power & Light Co

THERE'LL BE great doings "down in Arkinsaw" next December. Several hundred farmers and their wives, white and negro, from the state's 75 counties, will converge on Little Rock. The second group will be going to a sumptuous banquet at Arkansas Baptist College on December 7. The next evening at the Marion Hotel the others will gather round the groaning board in their turn. On both occasions important money will be handed out in prizes. And on both occasions the Arkansas Power & Light Co will pick up the tab and be mighty glad to do it.

The prizes will go to winners in the second annual round of the Arkansas Balanced Farming and Live-at-Home competitions, the former for white and the latter for negro entrants. Last year the Balanced Farming affair was attended by more than 350 farmers and their wives, and 300 sat down to the Live-at-Home competition dinner. The two 1947 groups plus those who will have a good meal on AP&L next December represent a total enrollment of over 12,500 in the competitions.



ANNOUNCEMENT of 1948 competitions distributed by Arkansas Press Association. Ratings of report books like this (right) will determine the winners

Organization of Competitions

The County Balanced Farming (and Live-at-Home) Committee shall consist of one or more newspaper publishers, county agent, home demonstration agent, Farmers Home Administration supervisor, farmers, and other persons the aforementioned may desire to have serve on the county committee with them. The state chairman shall appoint one publisher in each county as chairman of the county committee. The chairman, or some person responsible to him, shall see that an ample supply of entry blanks and report books are at hand at all times and that all outlets are kept supplied. He should also make a weekly check of all competition entries, and mail or have them mailed regularly to the central office of the Arkansas Press Association.

To make the competition more interesting and worthwhile to contestants it is suggested that the chairman and members of the county committee plan for and secure contributions for county awards in all divisions of competition, and to arrange special luncheon or banquet to honor all county winners. "Certificates of Honor", awarded to all county winners by the Arkansas Press Association, will be forwarded to each county holding an honorary banquet or luncheon, that the "Certificates of Honor" may be presented to the winners by the county committee, instead of at the state banquet.

The state chairman, (appointed by the president of the Arkansas Press Association) with the aid of the central office of the Association, shall endeavor to coordinate the efforts of the sponsor with those of its team mates—the Agricultural Extension Service, Farmers Home Administration, Arkansas Power and Light Company, Commercial Appeal "Plant-to-Prosper", district and county chairman and others interested in lending their aid to the state-wide program; provide rules and regulations pamphlets, entry blanks, entrants' report books, news releases and assemble and provide weekly reports of all entrants in both Arkansas Balanced Farming and Live-at-Home Competitions; and as soon as possible after June 1, (the entry closing date) provide each county with a grand total of all entrants.

Keystone of AP&L's ambitious rural development program and a powerful factor in its public relations picture, the competitions are purposed towards establishment of a better balanced, more stable, and more prosperous agriculture in the state. They cover all phases of farm life, improved home-making and bettered agricultural practices—forestry, soil conservation, livestock breeding, marketing of products, the whole gamut. The competitions are not limited to AP&L territory, which covers about a third of the state, but are open to every Arkansas farmer and farm family.

Soon after the program was started, the power company realized that it had taken on a whopping big job. Moreover the rapidly spreading implications of the program, its swift reaching out into areas of interest in which other than AP&L were importantly concerned, indicated that the job ought to be shared. Co-sponsors were sought and were readily found.

Among those who agreed to help are the Arkansas Press Association, the Agricultural Extension Service of the state university, the Farmers' Home Administration, and the Memphis (Tenn.) *Commercial Appeal.*

The competitions are organized on a county basis as detailed by the quoted paragraphs shown above. The Press Association handles the promotion. From its central office in Little Rock, executive secretary Bill Minor sends out frequent releases to local newspapers boosting the contests and urging enrollment in them. In cooperation with the personnel of the Extension Service and the Farm Home Administration, the county competitions are organized. Local business firms and individuals furnish prizes for county winners. These winners are entered in the state competitions. They are invited to the dinners at Little Rock, traveling expenses paid by AP&L, where the winners of state awards are announced. All winners of state prizes are automatically entered in the "Plant-to-Prosper" competition sponsored by the Memphis *Commercial Appeal.* This competition is of regional scope, covering Arkansas, Mississippi, Missouri, and Tennessee, and is a sort of sweepstakes race that tops off the competitions.

The two competitions are divided into 7 classes of entries as follows:

Balanced Farming Competition:

Tenants and sharecroppers. Cash awards of $200, $150, $100.

Landowners employing aid of not more than two families. Cash awards of $200, $150, $100.

Plantation owners employing aid of three or more families. Cash award of $100.

Home improvement. $50 award to tenant or sharecropper family making most improvement in their home.

Live-at-Home Competition:

Landowners. Cash awards $100, $50, $30, $20.

Tenants or sharecroppers. Cash awards $100, $50, $30, $20.

Home improvement. $50 to tenant or sharecropper family making most improvement in their home.

The above awards, totalling $1,500, are provided by Arkansas Power & Light Co and the Memphis *Commercial Appeal,* each contributing half. The "Plant-to-Prosper" sweepstakes competition, in which the state winners are automatically entered, offers awards totalling $1,100, contributed by the agricultural committee of the Memphis Chamber of Commerce, as follows:

Balanced Farming Group:

$500 to tenant or landowner making best record in living at home, diversification, soil conservation, and home improvement.

$250 to tenant or sharecropper making the best record in the competition.

$100 to the tenant or sharecropper family making the most improvement in their home.

Live-at-Home Group—

$250 to tenant or landowner making best record in living at home, diversification, soil conservation, and home improvement.

Additional to the cash and other prizes at the different competition levels, county, state and region, winners receive various trophies and certificates furnished by the Arkansas Press Association and the *Commercial Appeal.* Special trophies are awarded to editors of county newspapers who do most to make the competitions successful in their local areas.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

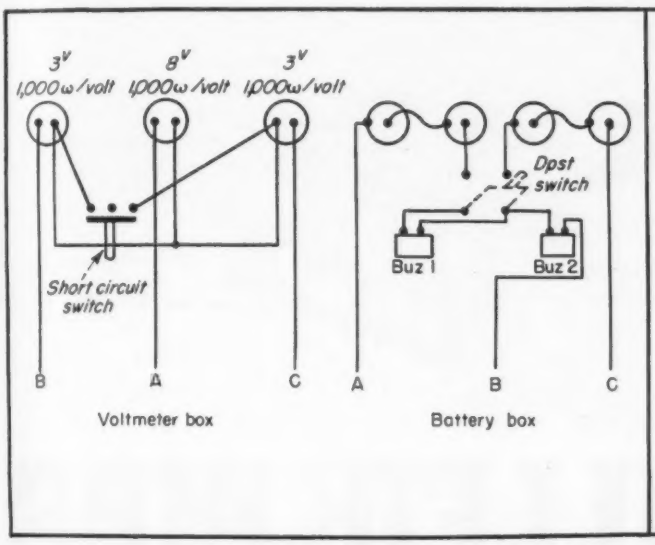


FIG 1—**INTERNAL CONNECTIONS** for voltmeter and battery boxes, and lead markings for each box

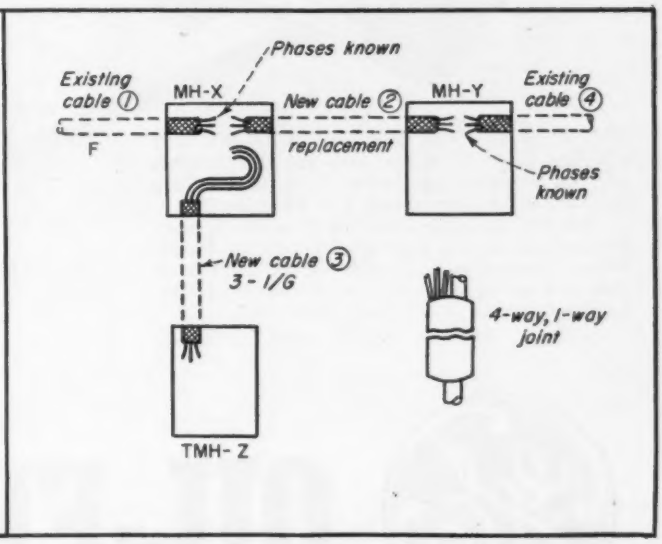


FIG 2—**TYPICAL ARRANGEMENT** of cable for a phasing-out operation in the field

Phasing Set Identifies Cable Conductors

G. J. GUTHRIE NICHOLSON, JR
Methods & Equipment Division
Consolidated Edison Co of New York, Inc

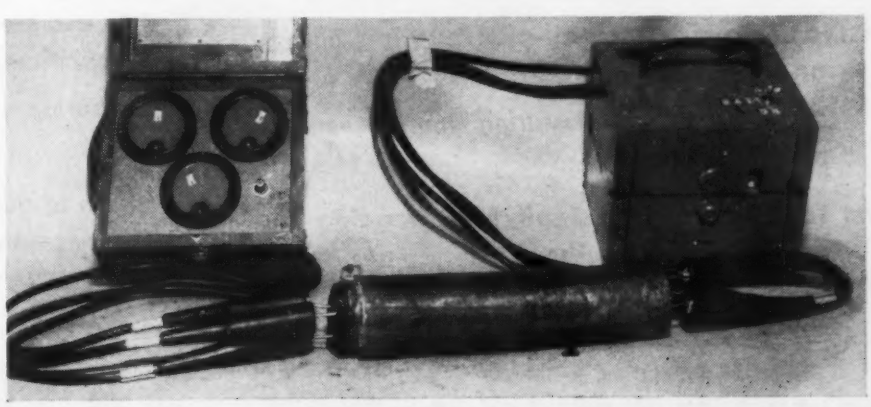
WITH THE PHASING EQUIPMENT described here, the "phasing out" of cable has been simplified to the point where the operation can be done by one man. That operation is required on dead sections of underground cable which are to be picked up for splicing into existing transmission and feeder circuits. This phasing set has been used on a 7-mile power cable circuit and given excellent satisfaction. In addition, it has operated over a 100-mile artificial line.

The phasing set (patent applied for) consists of two parts. One part is a battery box ($6\frac{3}{4}$ in. long x 6 in. wide x $6\frac{1}{8}$ in. high) in which are connected two buzzers, four $\frac{1}{2}$-v batteries, an "on-off" switch and three 2-ft long flexible leads terminating in connector clips and marked A, B and C, respectively.

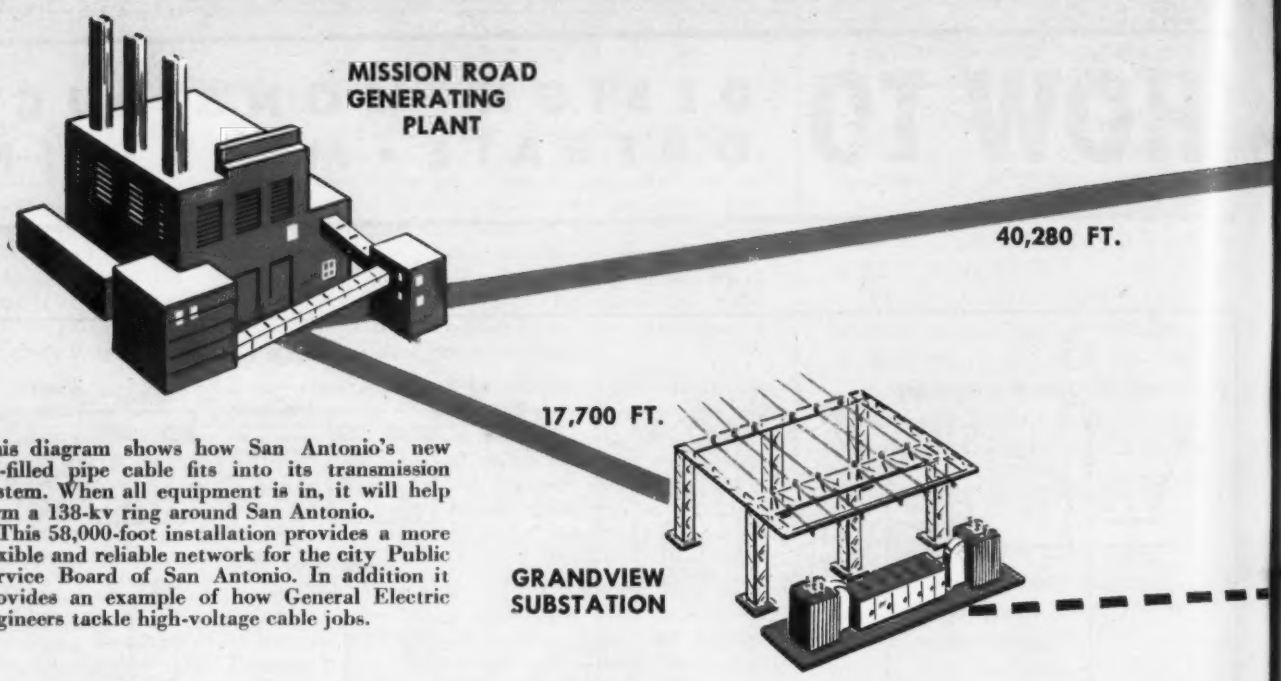
A second or voltmeter box (same size as battery box) contains three 1000-ohm-per-volt voltmeters. Full scale on two meters is 3 v; the third is 8 v. These meters are connected in wye with one of the 3-v meters reversed. Three leads marked A, B and C extend from this box. A three-pole push button switch, used to short circuit the A, B and C leads for signaling purposes, is included for the use of a two-man team.

Operation of the phasing set is such that, only when leads marked A B C from the battery box are connected to opposite ends of same conductors as leads marked A B C from the voltmeter box, will each voltmeter have its pointer showing in the window visible in the photograph. Internal connections of battery and voltmeter boxes are shown in Fig 1.

For a typical splicing operation, consider conditions outlined in Fig 2. In manholes *X* and *Y* are shown existing open-ended distribution feeder cables (1) and (4) in which the phases are known. A new three-conductor cable (2) has been pulled



PHASING SET consists of voltmeter box (left) and battery box (right). A model cable connection is shown



This diagram shows how San Antonio's new oil-filled pipe cable fits into its transmission system. When all equipment is in, it will help form a 138-kv ring around San Antonio.

This 58,000-foot installation provides a more flexible and reliable network for the city Public Service Board of San Antonio. In addition it provides an example of how General Electric engineers tackle high-voltage cable jobs.

OIL-FILLED PIPE

— An Example of

HERE is an illustration of the skill and care with which G-E engineers tackle high-voltage cable installations. It helps explain why the San Antonio installation is technically the soundest system of its type, and at the same time has the lowest installed cost.

At San Antonio, G.E. was

first to control racing cycles of oil pumps,
reducing contactor and motor wear

first to use compressed-air-plug-purging method on a pipe cable,
saving time and assuring more complete moisture removal

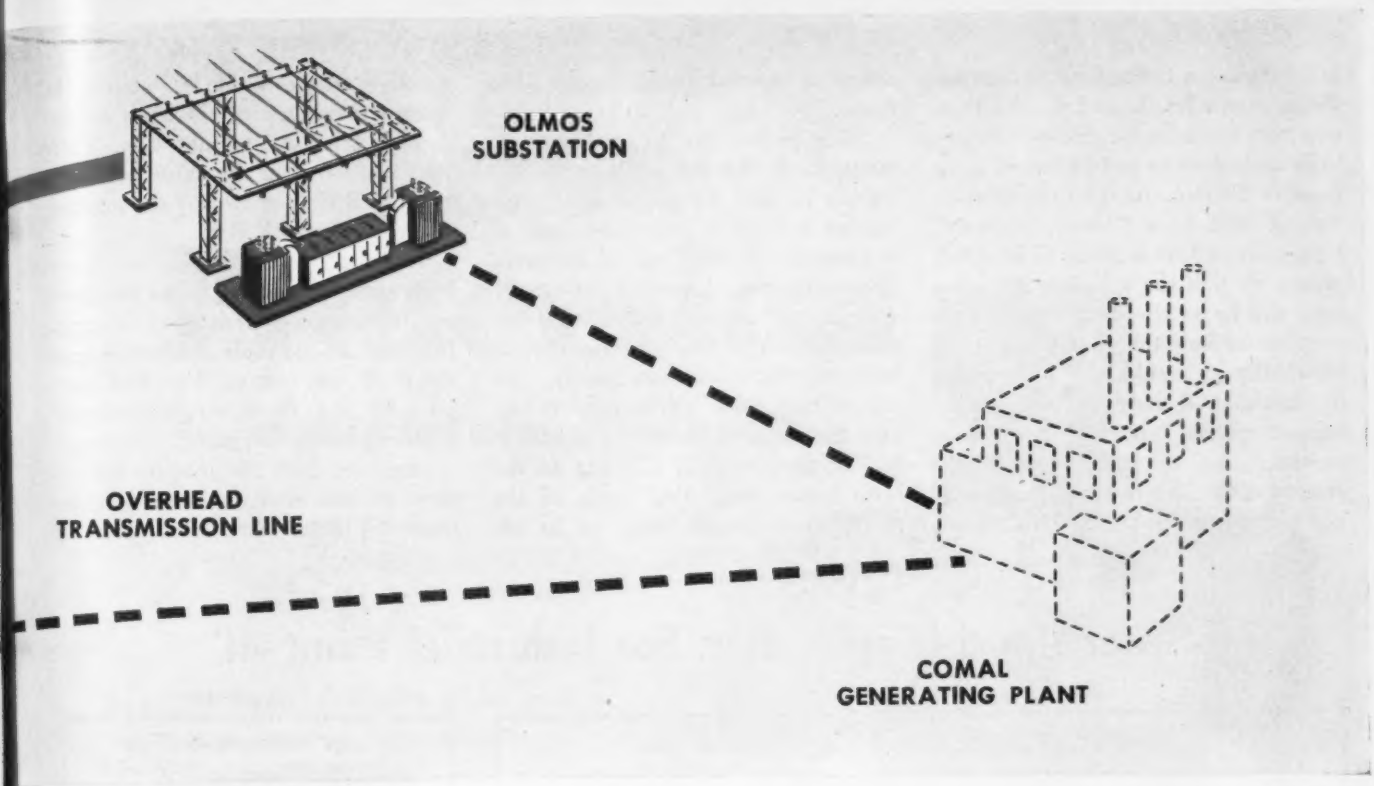
first to use compressed air for threading the pulling line into pipe,
saving installing time

first to provide for the elimination of free moisture which can chill out in tank,
safeguarding cable life

first to ship oil under controlled positive nitrogen pressure,
preventing oxygen and moisture contamination

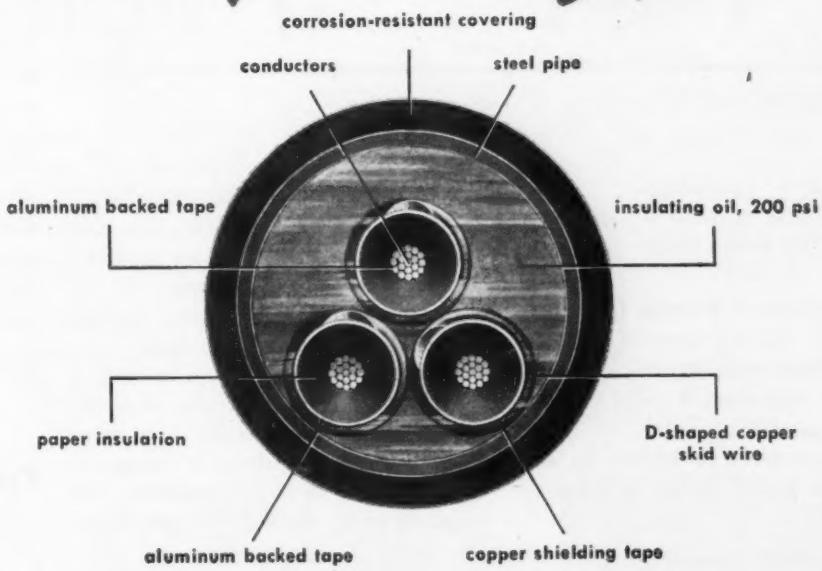
first to use steel pipe with rigid carbon content specifications,
assuring uniform weld strength and tightness.

Each of these innovations plus careful co-ordination of engineering, manufacturing, and installation service helped assure better quality in the installed system, plus a lower final cost.



CABLE

Good Cable Engineering!



When you consider a high-pressure system, let G-E engineers save you money. These engineers are constantly devising new and better installation methods. They design and make the only complete line of high-voltage cable accessories; they are continuously pioneering basic advances in cable technology. They are ready to serve you. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

This is the Cable!

GENERAL ELECTRIC

502-8M

in to replace a burned-out section between manholes X and Y. Further, new single-conductor cables (3) are to be picked up to go to a transformer bank in TMH-Z. As the joint in manhole *X* will be a "4-way, one-way" type, every effort is made to establish phases so that the splicing operation here will be as simple as possible regardless of how the phases match up physically at manhole *Y*. The joint in manhole *Y* may be a so-called crossed phase type. This involves crossing two conductors physically around each other without mismatching phases electrically. This necessitates a special joint, longer than usual.

Since phases are to be "held" in manhole *X*, the battery box is first set up at this location. Using the battery box as a buzzer set, test all conductors to be clear of grounds. Then connect each lead, A B C, to the desired conductor respectively in cable (2). If there is a short circuit between any two conductors, the buzzer or buzzers will sound. If not, take the voltmeter box to manhole *Y* and apply the A B C leads to the open cable ends until each of the three meter hands show in its respective window. It is possible to have a maximum of six trials before making the correct connection. Then the conductors of the cable are identified A B C as shown by the marked voltmeter leads A B C.

When the cable conductors have been securely marked, push the short circuiting switch three times to signal the man in manhole *X* that he can clear off the battery box and start phasing the three single-conductor cables to manhole TMH-Z. Of course if one man does the job, he can return to the first location and remove the battery box.

Steamlined Distribution For Industrial Plant—II*

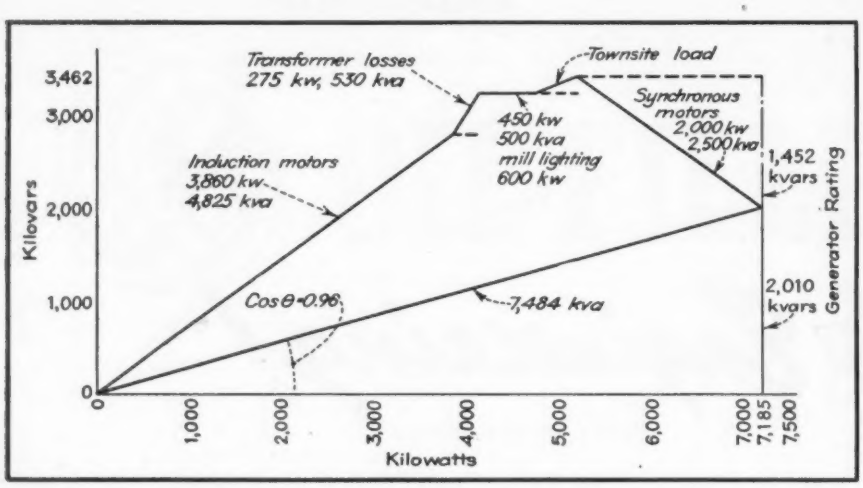


FIG 3—POWER FACTOR correction by synchronous motors

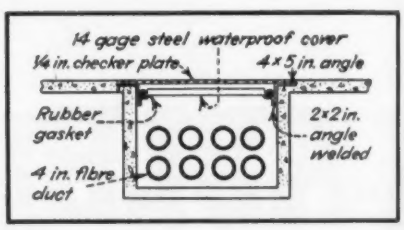


FIG 4—MANHOLES have waterproof cover to guard against chemicals entering duct and can be flushed should corrosive materials enter the duct system

H. E. STAFFORD
Consulting Electrical Engineer
Port Arthur, Ontario

A DISTRIBUTION SYSTEM for a sulphate pulp mill and townsite in northwestern Ontario incorporates 13 feeders for 15 load centers (EW, Oct. 23, 1948, page 100). Total connected load is equivalent to 16,605 hp and the system power factor is approximately 96%.

Insulated Feeder Cable

The feeder cables are run in 4-in. conduit from the switchroom to the ground floor elevation and in fiber duct under the floor to the 6900/575-v transformers. Cables are 3-conductor, No. 2/0, 15,000-v, varnished-cambric insulated, lead-covered.

Manholes at strategic points facilitate pulling and inspecting the primary cables. Fig 4 shows a cross-section of a typical manhole with its waterproof cover to guard against chemicals entering duct and manholes. The duct system can be flushed with fresh water containing a small amount of sulphuric acid. This solution neutralizes corrosive effect of caustic (used in the manufacture of sulphate pulp) should the latter flood the floor.

Secondary feeders from transformers to cubicles are made up of 250,000 cir mil conductors with varnished cambric and braid insulation. Three parallel conductors are used in each phase.

Motor sizes and speeds are standardized insofar as possible and enough synchronous motor capacity is maintained for high power factor.

System connected load: industrial induction motors 10,780 hp; industrial synchronous motors 3,525 hp; mill lighting 800 hp; townsite power and lighting 1,500 hp.

With a load factor of 58%, the average load is 7,185 kw. A breakdown of this load is shown in the graph, Fig 3. It is interesting to note that without overexciting any of the synchronous motors, the system power factor fluctuates between 96 and 97%.

* This is the second of two articles.

Transformer Mounting Saves Customer $6,000

LARGE TRANSFORMER manufacturers recently have devised a real solution to the problem of handling spare transformers. As illustrated, transformers are mounted on double-flanged wheels that can be rotated 90 deg when resting on a steel plate where the rails cross. "Casters" are turned by jacking up the transformer,

Fuse Protection

completely enclosed

G-E Oil Fuse Cutouts give you

- **high interrupting capacity**
- **low maintenance**
- **quiet and safe operation**

G-E oil fuse cutouts are particularly applicable for indoor installations, for vault and subway service, and for outdoor pole-type installation where high interrupting capacity is required on 2400-, 4160-, 4800-, and 7200-volt utility and industrial circuits.

All arcing, with current interruption or switching, occurs *under oil*. The housing, with its drawn-steel tank threaded into a cast-iron cover, will withstand any internal pressures that can possibly occur within the cutout's interrupting rating. There are no exposed live parts—whether cutout is in open or closed position—and no expulsion of arc-flame.

Special arcing surfaces on the heavy self-aligning contacts keep load-carrying contact surfaces clean—make it possible to use these cutouts repeatedly as switches to open circuits under load, either with disconnecting blade or fuse links.

Full information is covered in bulletin GEA-732—available through your G-E Apparatus Office, or by writing *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

AVAILABLE RATINGS

Circuit Voltage	Max Continuous Amperes	Interrupting Rating* Max RMS Amperes
2400 } 4160 }	100	6000
	200	11000
	300	11000
4800	100	5000
	200	10000
	300	10000
7200	100	3750

** With G-E new Universal Fuse Links*

GENERAL ELECTRIC

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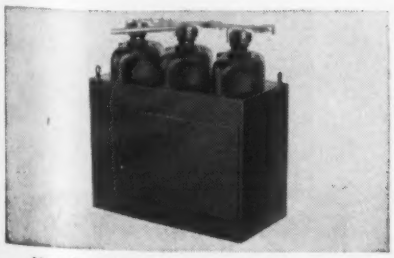
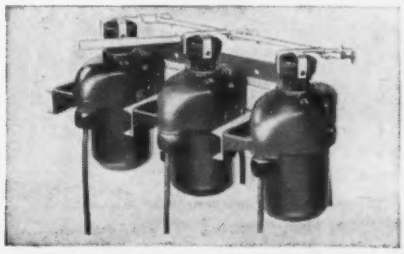
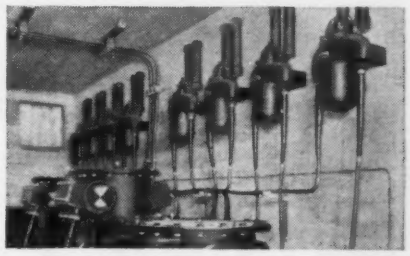


Metal-enclosed 3-phase assemblies have become increasingly popular for various indoor installations.



Gang-operating mechanism can be supplied for opening 3-phase circuits. Shown on pole-type cutouts, but also available with metal-enclosed and subway-type assemblies.



For subway service, expansion chambers attached to cutouts permit complete submersion.

Pawtucket serves a 1725-KW

For low-cost dependability and flexibility—today and tomorrow

Many people think of secondary networks as suitable only for very large loads, covering a sizable area, and arranged in a conventional grid pattern. Yet here is a case where an initial network will supply an area with a total peak load of 1725 kilowatts—and with the secondary mains confined essentially to a 600-foot portion of a single street.

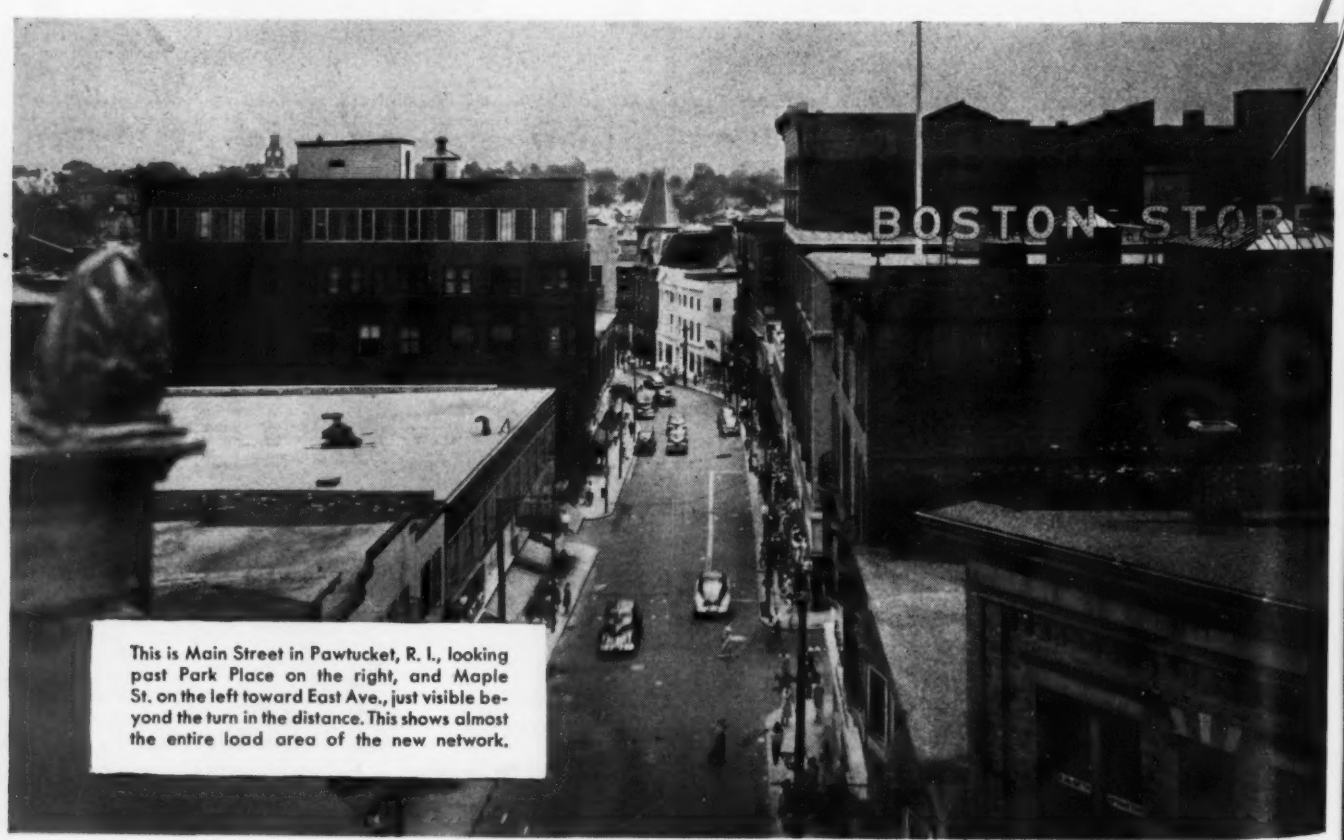
The city is Pawtucket, R. I., served by the Blackstone Valley Gas and Electric Company. The installation, as originally engineered, involved a two-block business district on Main Street, between High and North Union.

Load growth was the problem

This portion of the business district has been served by a radial system, principally underground. There are thirteen grouped loads to be served—with peak requirements from 40 to 240 kw. With buildings recently modernized, three recently air conditioned, it seemed only a matter of time before growing load would make the present radial system inadequate.

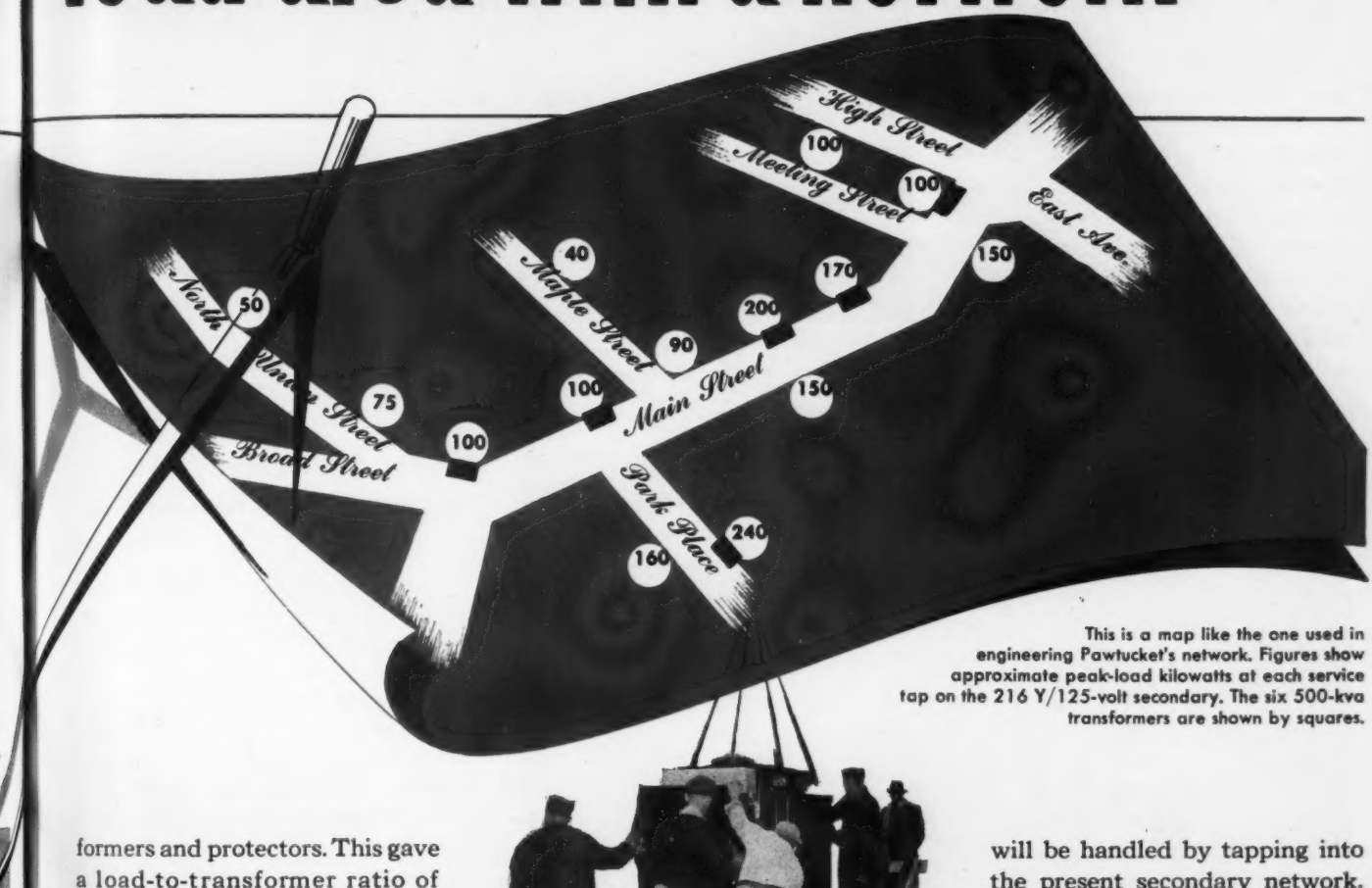
A network proved practical

The situation seemed to call for a network, and study proved that all requirements of an ideal network could be met economically—including proper loading of transformers and cables during both normal and abnormal conditions, while maintaining close voltage tolerances. Three 14,400-volt primary feeders were used with six 500-kva standardized network units—trans-



This is Main Street in Pawtucket, R. I., looking past Park Place on the right, and Maple St. on the left toward East Ave., just visible beyond the turn in the distance. This shows almost the entire load area of the new network.

load area with a network



This is a map like the one used in engineering Pawtucket's network. Figures show approximate peak-load kilowatts at each service tap on the 216 Y/125-volt secondary. The six 500-kva transformers are shown by squares.

formers and protectors. This gave a load-to-transformer ratio of 57.5%—about average for initial network installations.

Present load can increase seven-fold without adding primary feeders or increasing size of secondary mains

With an initial transformer loading of less than 60%, this installation will provide full network flexibility. Some increase—and shifting—in load can be handled with no excessive overload, even with one feeder out of service.

As load grows, it will, of course, be necessary to add transformers. However, no additional primary feeders will be required, and the size of secondary mains need not be increased. New loads within the present area will be handled by tapping into the present secondary network. New transformers will be tapped into existing primary feeders and tied into the existing secondary.

Pawtucket gained by selecting standardized G-E transformers and protectors—cut delivery time, saved money over the cost of non-standard designs.

Present plans call for extending the network to include ten rather than six transformers and to cover three blocks rather than two.

This installation brings out one of the big advantages of the secondary network—how, for high-quality service, it is the simplest and least expensive system to expand, the ideal system to meet growing loads. For additional information—and a copy of a new leaflet on secondary networks (GET-1487) — call your G-E representative or write Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

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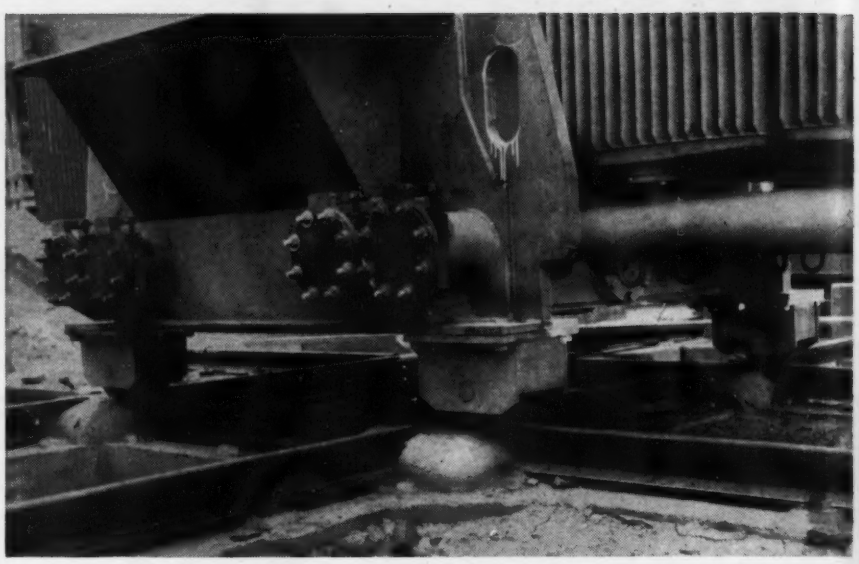
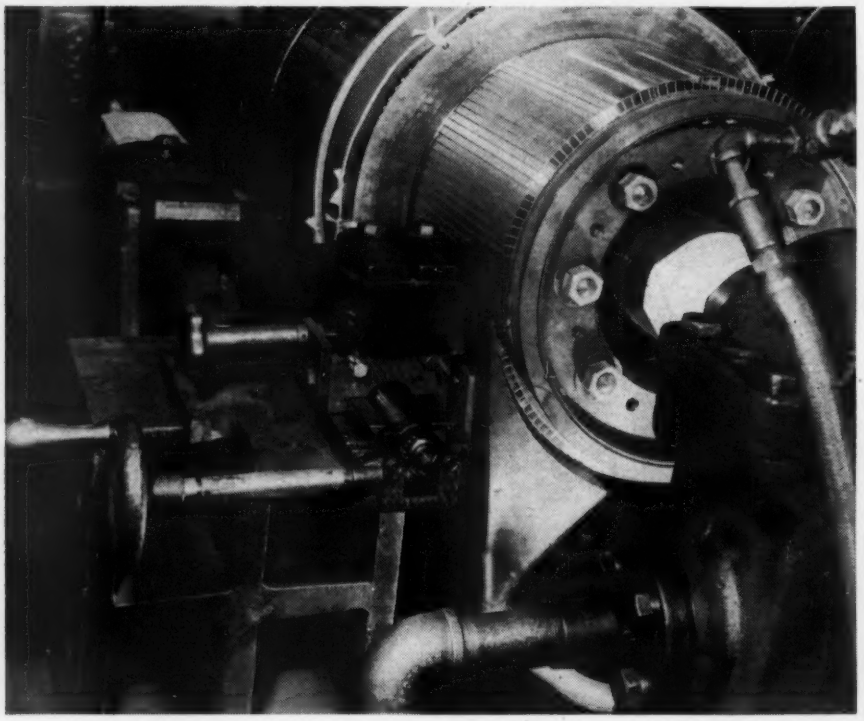
removing four cap screws and then rotating the casters on a king-pin.

This mounting for handling spares is used by at least two of the large manufacturers and offers important savings to the customer. The transformer shown is one constituting a large bank a Midway substation of Pacific Gas and Electric Co. Approximately $6,000 was saved by the new handling provision. Formerly it was necessary to use an expensive transfer car. Moreover, either the transfer track had to be recessed in an expensive trench or the transformer had to be mounted on rails on about 2-ft concrete pedestals. In either case, considerable cost was added to the job. All of this is avoided by the new system.



"CASTERS" on heavy transformers avoid need for transfer car. Transformer is jacked up and wheels turned 90 deg when directly over rail crossings



DUST COLLECTORS' funnel top fits commutator radius and always follows the stoning operation

Vacuum Dust Collector Improved

AN IMPROVED vacuum dust collector, which eliminates the need for the operator wearing a mask while dressing commutators, has been developed in the Allis-Chalmers Mfg Co's West Allis Works. As shown, it has an elongated funnel top, is curved to fit the commutator radius and covers a generous portion of the circumferential area. The under slung funnel top is attached directly to the lathe tool slide, and therefore is always directly under the stone. A flexible hose connects the funnel and vacuum system.

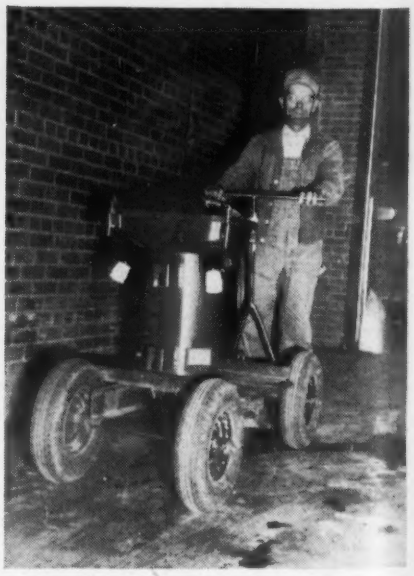
These factors make it possible for the vacuum system to remove quickly all the copper, mica and stone dust resulting from the operation. The device has proven itself in the commutator seasoning process.

Simple Cart Eases Handling of Transformers

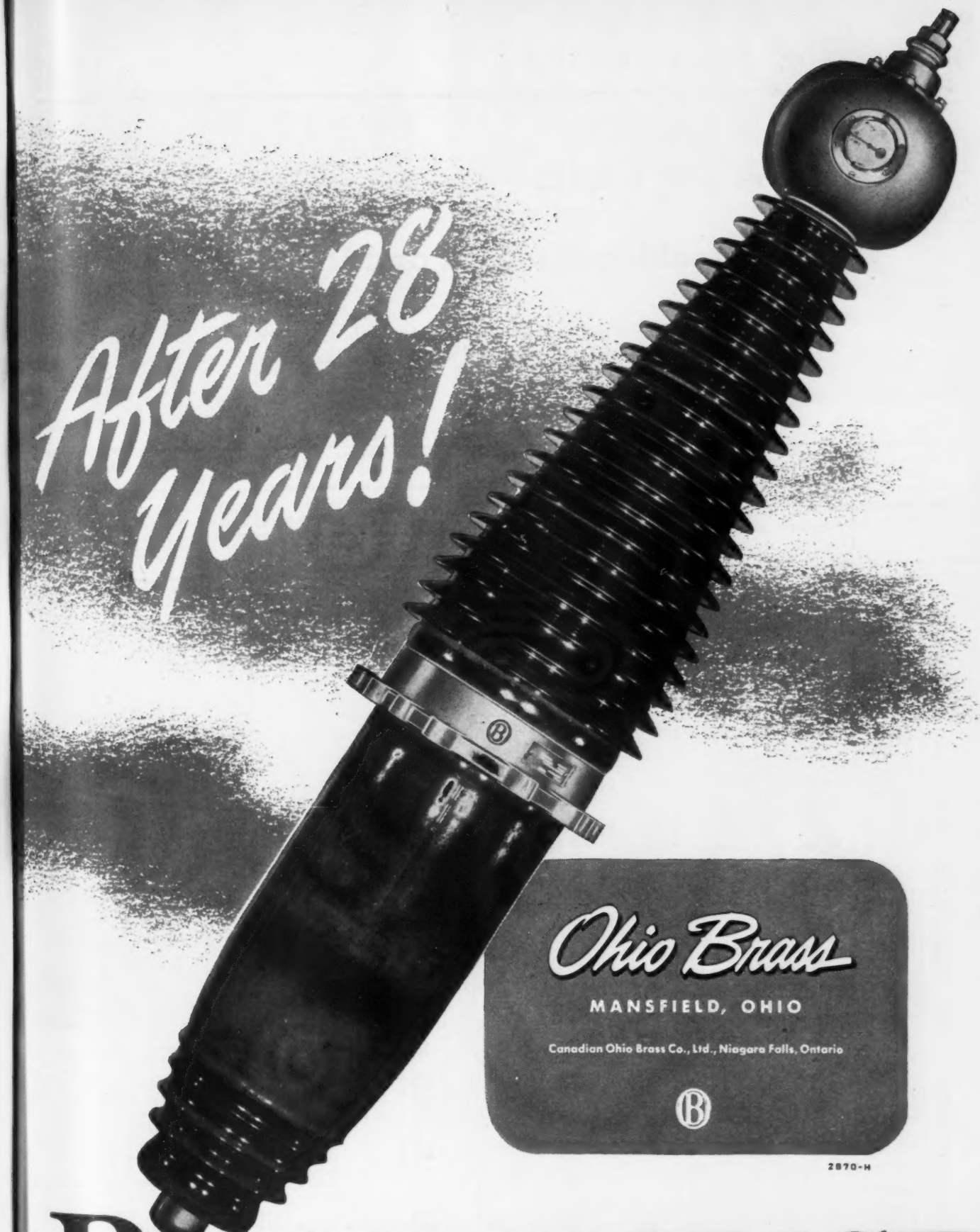
A CART for hauling transformers between poles that are inaccessible to the line truck is being used by Oklahoma Gas & Electric Co.

Customers like it because transformers are moved without damaging lawns. Line crews like it because it is easier to roll the equipment.

The all-welded cart is made with 4-in. channel iron supports, $\frac{3}{8}$-in. sheet steel floor with 2-in. angle iron ends, and has 1-in. steel tubing handle. It is 60-in. long and 26-in. wide.



TRANSFORMER CART with rubber tires simplifies handling of transformers in the shop and in the field


After 28 Years!
Ohio Brass
MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ontario
2870-H

PREFERENCE

Copper Wire Data

Weight, Breaking Strength and D-C Resistance

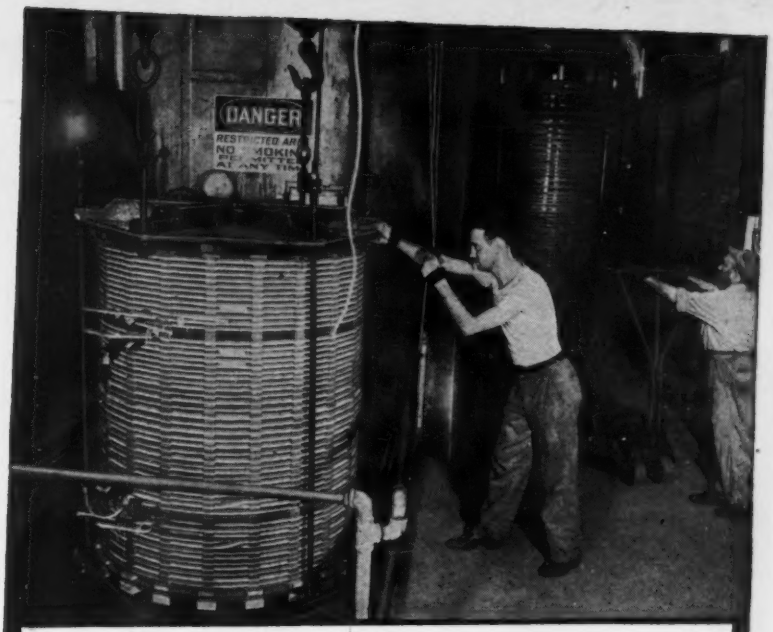
Table is adapted from advance pages for forthcoming 8th edition of Standard Handbook for Electrical Engineers

(Based on ASTM Specifications B1-47, B2-47, B3-45)

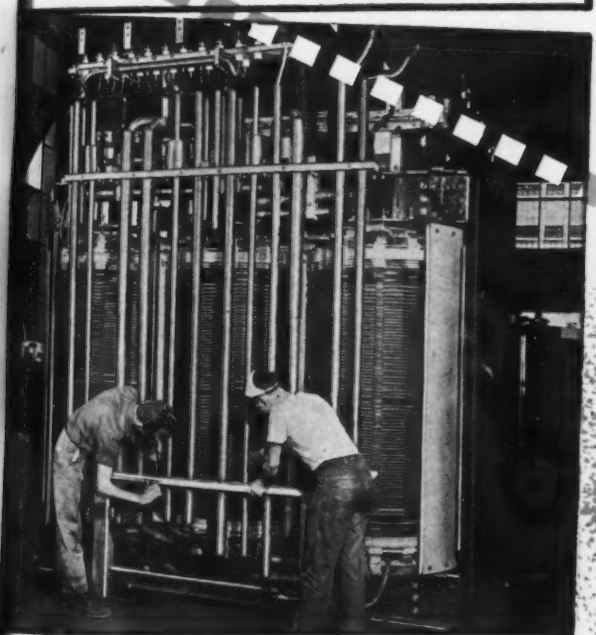
Size, Awg	Diameter in.	Area		Weight		Hard		Medium		Soft	
		Cir mil	Sq in.	Lb per 1000 ft	Lb per mile	Breaking strength, minimum,* lb	D-c resistance at 20 C (68 F) maximum,† ohms per 1000 ft	Breaking strength, minimum,* lb	D-c resistance at 20 C (68 F) maximum,† ohms per 1000 ft	Breaking strength, maximum,‡ lb	D-c resistance at 20 C (68 F) maximum,† ohms per 1000 ft
4/0	0.4600	211,600	0.1662	640.5	3382	8143	0.05045	6980	0.05019	5983	0.04901
3/0	0.4096	167,800	0.1318	507.9	2682	6722	0.06361	5667	0.06329	4745	0.06180
2/0	0.3648	133,100	0.1045	402.8	2127	5519	0.08021	4599	0.07980	3763	0.07793
1/0	0.3249	105,500	0.08289	319.5	1687	4517	0.1011	3730	0.1006	2984	0.09827
1	0.2893	83,690	0.06573	253.3	1338	3688	0.1289	3024	0.1282	2432	0.1239
2	0.2576	66,370	0.05213	200.9	1061	3003	0.1625	2450	0.1617	1929	0.1563
3	0.2294	52,630	0.04134	159.3	841.2	2439	0.2049	1984	0.2038	1530	0.1970
4	0.2043	41,740	0.03278	126.4	667.1	1970	0.2584	1584	0.2570	1213	0.2485
5	0.1819	33,100	0.02600	100.2	529.1	1591	0.3258	1265	0.3241	961.9	0.3133
6	0.1620	26,250	0.02062	79.46	419.6	1280	0.4108	1010	0.4087	762.9	0.3951
7	0.1443	20,820	0.01635	63.02	332.7	1030	0.5181	806.6	0.5154	605.0	0.4982
8	0.1285	16,510	0.01297	49.97	263.9	826.0	0.6533	643.9	0.6499	479.8	0.6282
9	0.1144	13,090	0.01028	39.63	209.3	661.2	0.8238	514.2	0.8195	380.5	0.7921
10	0.1019	10,380	0.008155	31.43	165.9	529.2	1.039	410.4	1.033	314.0	0.9989
11	0.09074	8,234	0.006467	24.92	131.6	422.9	1.310	327.6	1.303	249.0	1.260
12	0.08081	6,530	0.005129	19.77	104.4	336.9	1.652	261.6	1.643	197.5	1.588
13	0.07196	5,178	0.004067	15.68	82.77	268.0	2.083	208.8	2.072	156.6	2.003
14	0.06408	4,107	0.003225	12.43	65.64	213.5	2.626	166.6	2.613	124.2	2.525
15	0.05707	3,257	0.002558	9.858	52.05	169.8	3.312	133.0	3.295	98.48	3.184
16	0.05082	2,583	0.002028	7.818	41.28	135.1	4.176	106.2	4.154	78.10	4.016
17	0.04526	2,048	0.001609	6.200	32.74	107.5	5.266	84.71	5.239	61.93	5.064
18	0.04030	1,624	0.001276	4.917	25.96	85.47	6.640	67.61	6.606	49.12	6.385
19	0.03589	1,288	0.001012	3.899	20.59	67.99	8.373	53.95	8.330	38.95	8.051
20	0.03196	1,022	0.0008023	3.092	16.33	54.08	10.56	43.05	10.50	30.89	10.15
21	0.02846	810.1	0.0006363	2.452	12.95	43.07	13.31	34.36	13.24	24.50	12.80
22	0.02535	642.4	0.0005046	1.945	10.27	34.26	16.79	27.41	16.70	19.43	16.14
23	0.02257	509.5	0.0004001	1.542	8.143	27.25	21.17	21.87	21.06	15.41	20.36
24	0.02010	404.0	0.0003173	1.223	6.458	21.67	26.69	17.45	26.56	12.69	25.67
25	0.01790	320.4	0.0002517	0.9699	5.121	17.26	33.66	13.92	33.49	10.07	32.37
26	0.01594	254.1	0.0001996	0.7692	4.061	13.73	42.44	11.11	42.22	7.983	40.81
27	0.01420	201.5	0.0001583	0.6100	3.221	10.92	53.52	8.863	53.24	6.331	51.47
28	0.01264	159.8	0.0001255	0.4837	2.554	8.698	67.49	7.070	67.14	5.020	64.90
29	0.01126	126.7	0.00009954	0.3836	2.026	6.918	85.10	5.640	84.66	3.981	81.84
30	0.01003	100.5	0.00007894	0.3042	1.606	5.502	107.3	4.499	106.8	3.157	103.2
31	0.008928	79.70	0.00006260	0.2413	1.274	4.376	135.3	3.589	134.6	2.504	130.1
32	0.007950	63.21	0.00004964	0.1913	1.010	3.485	170.6	2.862	169.8	1.986	164.1
33	0.007080	50.13	0.00003937	0.1517	0.8011	2.772	215.2	2.283	214.1	1.575	206.9
34	0.006305	39.75	0.00003122	0.1203	0.6353	2.204	271.3	1.821	269.9	1.249	260.9
35	0.005615	31.52	0.00002476	0.09542	0.5038	1.755	342.1	1.452	340.4	0.9904	329.0
36	0.005000	25.00	0.00001963	0.07567	0.3996	1.396	431.4	1.158	429.2	0.7854	414.8
37	0.004453	19.83	0.00001557	0.06001	0.3169	1.110	544.0	0.9238	541.2	0.6228	523.1
38	0.003965	15.72	0.00001235	0.04759	0.2513	0.8829	686.0	0.7367	682.4	0.4939	659.6
39	0.003531	12.47	0.000009793	0.03774	0.1993	0.7031	865.0	0.5876	860.5	0.3917	831.8
40	0.003145	9.888	0.000007766	0.02993	0.1580	0.5592	1091	0.4685	1085	0.3106	1049
41	0.002800	7.842	0.000006159	0.02374	0.1253	.....	1375	.....	1368	.....	1323
42	0.002494	6.219	0.000004884	0.01882	0.09939	.....	1734	.....	1725	.....	1668
43	0.002221	4.932	0.000003873	0.01493	0.07882	.....	2187	.....	2176	.....	2103
44	0.001978	3.911	0.000003072	0.01184	0.06251	.....	2758	.....	2743	.....	2652
ASTM Specification Designation						B1-47		B2-47		B3-45	

* No. 19 Awg and smaller, based on Anaconda data.
† Based on nominal diameter and ASTM resistivities.
‡ No. 24 Awg and smaller, based on ASTM B3-41.

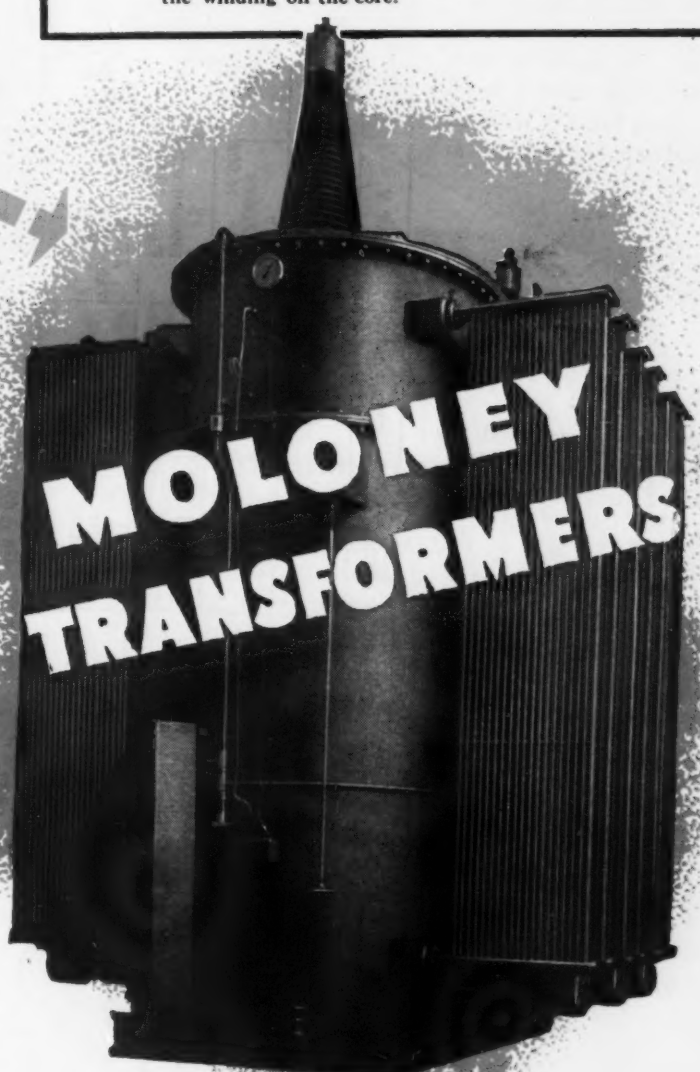
2 Pressboard spacers separate the individual disc coils and are fastened to the spacer bars which provide the vertical oil ducts between windings. This permits accurate alignment, providing mechanical strength to withstand the forces encountered under short circuit conditions. Connections between coils are gun-brazed as shown in the photo, and then thoroughly insulated.



3 Following assembly of the stack of disc coils into a continuous winding, it is compressed to the proper vertical dimension, securely clamped, then subjected to a series of drying, varnish impregnating and baking operations. These serve to (1) remove moisture from the insulating materials, (2) seal the windings against moisture, (3) provide mechanical strength for ease of handling when installing the winding on the core.



6 Photo shows completed core-and-coil assembly for a small three-phase power transformer, ready for preliminary testing. Leads are anchored firmly by means of insulating tubing. Lead connections have been carefully brazed and insulated. Insulating shields have been placed between phases and between the end plates and the windings.



MOLONEY TRANSFORMERS

LECTRIC COMPANY

ACTORIES AT ST. LOUIS, MISSOURI AND TORONTO, ONTARIO, CANADA

Periodic Arrangement Of The Chemical Elements

Chart gives latest data for the various groups of the chemical elements.

Above the name of each element is its atomic number; below, is its symbol at left and atomic weight at right.

Chart is reproduced by permission of General Electric Co, Schenectady, N. Y.

PERIOD	GROUP 0	GROUP I	GROUP II	GROUP III	GROUP IV	GROUP V	GROUP VI	GROUP VII	GROUP VIII
I		1 HYDROGEN H 1.0080							
II	2 HELIUM He 4.003	3 LITHIUM Li 6.940	4 BERYLLIUM Be 9.02	5 BORON B 10.82	6 CARBON C 12.010	7 NITROGEN N 14.008	8 OXYGEN O 16.000	9 FLUORINE F 19.00	
III	10 NEON Ne 20.183	11 SODIUM Na 22.997	12 MAGNESIUM Mg 24.32	13 ALUMINUM Al 26.97	14 SILICON Si 28.06	15 PHOSPHORUS P 30.98	16 SULPHUR S 32.066	17 CHLORINE Cl 35.457	
IV	18 ARGON A 39.944	19 POTASSIUM K 39.096	20 CALCIUM Ca 40.08	21 SCANDIUM Sc 45.10	22 TITANIUM Ti 47.90	23 VANADIUM V 50.95	24 CHROMIUM Cr 52.01	25 MANGANESE Mn 54.93	26 IRON Fe 55.85
		29 COPPER Cu 63.54	30 ZINC Zn 65.38	31 GALLIUM Ga 69.72	32 GERMANIUM Ge 72.60	33 ARSENIC As 74.91	34 SELENIUM Se 78.96	35 BROMINE Br 79.916	27 COBALT Co 58.94
									28 NICKEL Ni 58.69
V	36 KRYPTON Kr 83.7	37 RUBIDIUM Rb 85.48	38 STRONTIUM Sr 87.63	39 YTTRIUM Yt 88.92	40 ZIRCONIUM Zr 91.22	41 COLUMBIUM Cb 92.91	42 MOLYBDENUM Mo 95.95	43 TECHNETIUM Tc 99	44 RUTHENIUM Ru 101.7
		47 SILVER Ag 107.880	48 CADMIUM Cd 112.41	49 INDIUM In 114.76	50 TIN Sn 118.70	51 ANTIMONY Sb 121.76	52 TELLURIUM Te 127.61	53 IODINE I 126.92	45 RHODIUM Rh 102.91
									46 PALLADIUM Pd 106.7
VI	54 XENON Xe 131.3	55 CESIUM Cs 132.91	56 BARIUM Ba 137.36	57-71 *	72 HAFNIUM Hf 178.6	73 TANTALUM Ta 180.88	74 TUNGSTEN W 183.92	75 RHENIUM Re 186.31	76 OSMIUM Os 190.2
		79 GOLD Au 197.2	80 MERCURY Hg 200.61	81 THALLIUM Tl 204.39	82 LEAD Pb 207.21	83 BISMUTH Bi 209.00	84 POLONIUM Po 210	85 ASTATINE At 211	77 IRIDIUM Ir 193.1
									78 PLATINUM Pt 195.23
VII	86 RADON Rn 222	87 FRANCIUM Fr 223	88 RADIUM Ra 226.05	89-96 **					

*VI	57 LANTHANUM La 138.92	58 CERIUM Ce 140.13	59 PRASEODYMIUM Pr 140.92	60 NEODYMIUM Nd 144.27	61 PROMETHEUM Pm 147	62 SAMARIUM Sa 150.43	63 EUROPIUM Eu 152.00	64 GADOLINIUM Gd 156.9	} Rare Earths								
	65 TERBIUM Tb 159.2	66 DYSPROSIUM Dy 162.46	67 HOLMIUM Ho 164.94	68 ERBIUM Er 167.2	69 THULIUM Tm 169.4	70 YTTERBIUM Yb 173.04	71 LUTECIUM Lu 174.99										
**VII	89 ACTINIUM Ac 227.05	90 THORIUM Th 232.12	91 PROTACTINIUM Pa 231	92 URANIUM U 238.07	93 NEPTUNIUM Np 237	94 PLUTONIUM Pu 239	95 AMERICIUM Am 241	96 CURIUM Cm 242									

STRONG.. STRAIGHT.. SAFE..

J-M TRANCELL M DOORS make better cell structures

JOHNS-MANVILLE TRANCELL M provides cell structure doors that are strong . . . free from warpage . . . highly resistant to severe shock and station fires.

Basically asbestos, this durable yet lightweight material is easy to cut and drill with ordinary shop tools. After a door is cut to size, it is finished easily and quickly by mounting hardware directly on panel. Standard latches or those which padlock, steel or wood handles, steel hangers or hinges—all can be used with Trancell M doors.

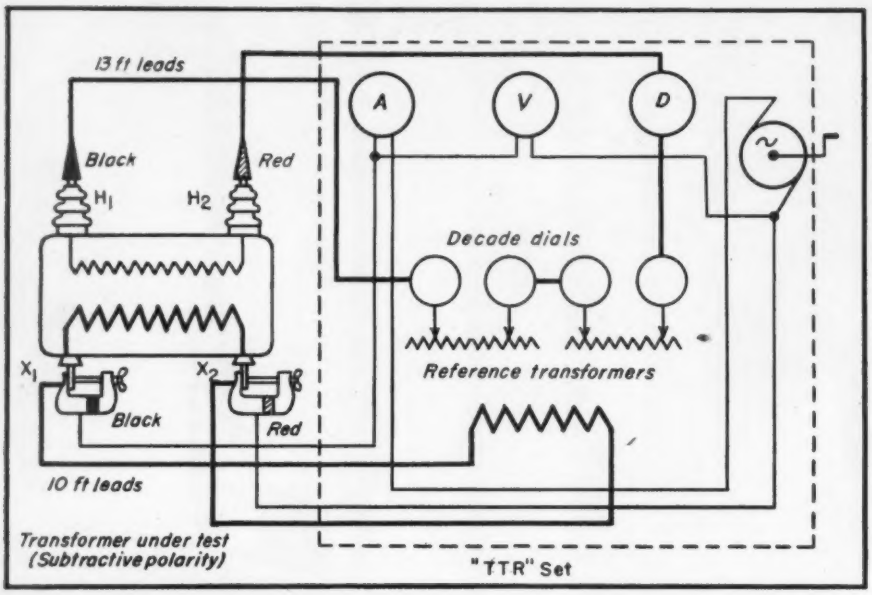
FLUSH CONSTRUCTION—With J-M Trancell M, wooden stiles or rails, metal trim, or other reinforcements are not required. The result is a neater job, all trim is flush, old style panelling is eliminated. Metal frames with grids are available for door cutouts when ventilation of structures is required.

Send today for full details about J-M Trancell M for cell structure doors . . . and J-M Trancell for better, safer cell structures and bus bar housings. Write Johns-Manville, Box 290, New York 16, N. Y.

Johns-Manville

TRANCELL
an asbestos product
for housing electrical equipment

Ratio Test Set Measures Transformer Coil Turns



TURN-RATIO test set discloses faulty ratios or windings. Excitation is supplied from the instrument. Four dials, direct-reading in turn ratio, are adjusted to obtain "back-to-back" null balance

By means of a portable turn-ratio test set, direct-reading measurements of turn ratio can be made on transformers. The set can be used with power and distribution transformers and autotransformers. Measurement is independent of the regulation characteristics of the transformer under test. The instrument is a development of R. L. Murray, Alabama Power Co (see Electrical World, April 29, 1944, page 1626), and is being manufactured by James G. Biddle Co.

Sources of transformer trouble, such as errors in turn count, incorrect taps and mislabeled terminals, may be detected indirectly by comparison to measured turn ratio. Shorted turns, interconnections between windings and errors or failures in tap-changers also affect the ratio.

The instrument operates on the principle that under no burden (no load) the voltage ratio of a transformer is almost exactly equal to its turn ratio. Connections between elements are shown in the diagram.

Designated the TTR set, the unit is essentially a reference transformer to be used by one operator. The device functions with the "back-to-back" connection by which the reference transformer is excited in parallel with the transformer under test, and the two transformers are connected in series on the high sides where the circulating current is brought to a null balance.

The reference transformer, tapped in decades, is adjusted in ratio by four dials to equal that of the transformer under test. This is indicated by a null balance showing zero circulating current. The turn ratio of transformer under test is read directly from a summation of the dial indexes, for example 63.745. Decimal point falls between the second and third dials.

An a-c hand-operated generator supplies 50 to 60-cycle excitation to the transformers. By varying input speed it is possible to control sensitivity as balance is approached.

The null detector or galvanometer has a 200-0-200 microamp d-c movement connected to a synchronous commutator on the generator shaft. This combination in series with the differential potential between secondaries of the transformers is sensitive to the in-phase component of circulating current. The galvanometer indicates the direction of unbalance and is sensitive only to the induced voltage component. The circuit is polarized so that change in galvanometer deflection follows the rotation of the dial knobs. Harmonic and quadrature components are suppressed by the synchronous commutator.

Galvanometer sensitivity is matched to the ratio increments so that at any ratio a change of 1 part per 1000 from balance will produce a galvanometer deflection of approximately $\frac{1}{16}$ in. Actual deflection of the galvanometer is proportional to the circulating current and will vary with the impedance of the transformer under test.

Final balance is obtained when the detector-galvanometer is at zero while the generator is being cranked to bring the applied potential to 8 v as indicated by the voltmeter. The exciting potential, frequency and current may vary somewhat according to test conditions, but are not critical.

In ordinary field use, turn ratios as measured by the TTR set may be expected to be accurate within 1 part in 1000 for ratios above unity and to the nearest division (0.001) for ratios below unity.

Hydrogen Pressure Increases Capacity

A survey among utilities experienced in the operation of hydrogen-cooled generators at pressures in excess of 0.5 psi, conducted by the Electrical Equipment Committee of the Edison Electric Institute, offers the following conclusions for the guidance of members contemplating conversion of machines to higher hydrogen pressure:

1. Use of higher hydrogen pressures up to 15 psi is practicable.

2. Before changing from 0.5 psi to higher pressures, individual machine and connected piping systems should be checked to predict and obviate any point where hydrogen leakage or accumulation may be dangerous.

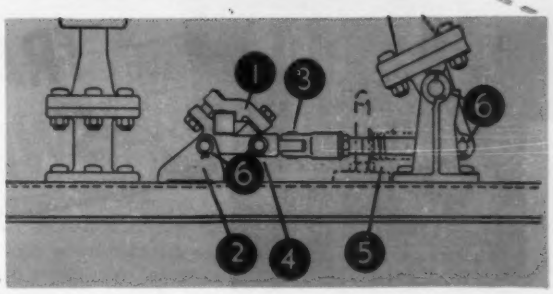
3. It is indicated that machine capacity can be increased from 15 to 17% by using 15 psi hydrogen pressure. Operation at higher pressures has not introduced any serious problems but has been useful in carrying higher loads without raising temperatures and in overcoming other problems.

4. Field and stator temperatures

CHANCE TYPE WN-VN Switches*

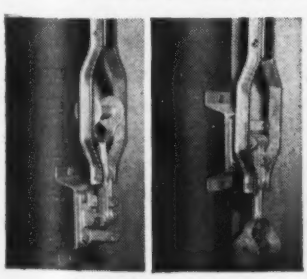
TYPE-WN

. . . have INDEPENDENT ROCKERSHAFT

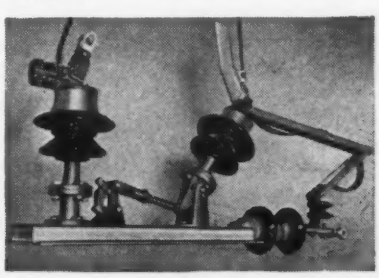


. . . and all these IMPORTANT FEATURES

- **POSITIVELY NO SLAMMING . . .** Chance WN or VN switches cannot be slammed closed because a special toggle joint (4) arrests the downward movement of the contact blade. Overtravel reverses direction.
- **EXTRA OPERATING LEVERAGE . . .** The Rockershaft design gives extra leverage for smooth, easy operation. This, plus action of the toggle joint, gives ample power to break ice accumulations with only moderate effort. Bumper spring (5) cushions operating movement of tilting insulator, boosts closing motion.
- **UNIFORM CONTACTS—ALL PHASES . . .** The Rockershaft mechanism operates independently of the tilting insulator making positive contact on all phases. Mechanism is on dead center when blades are closed. Effect of distortion of control shaft is negligible, each blade in three pole switch making complete contact without affecting the other two blades. Blades and clips are silver plated, clips self aligning.



SPADE TYPE HANDLE



TYPE-VN

Plus

- **UNIVERSAL TERMINALS . . .** Terminal clamp cap may be reversed to accommodate smaller conductors. Range: No. 4 solid copper up to 600M C. M. cable or ½" and ¾" I. P. S. tubing.
- **SIMPLIFIED INSTALLATION AND ALIGNMENT . . .** Removable clamp (1) permits the operating shaft to be laid in position after switch units are mounted. No threading required. Rockershaft base (2) may be turned to aid alignment with operating shaft. This base and Universal joint (3) help compensate for cross arm warpage after installation.
- **NO OILING—SMOOTH PERFORMANCE . . .** All working joints fitted with Oilite bearings (6). Smooth operation, no field maintenance.

C481

Write for Bulletin SW11-47

* CHANCE SWITCHES (FORMERLY BOWIE) ARE BACKED BY 42 YEARS OF SWITCH ENGINEERING AND MANUFACTURING EXPERIENCE

A·B·CHANCE CO·

210 N. ALLEN STREET CENTRALIA, MISSOURI · 615 TENNESSEE STREET SAN FRANCISCO 7, CALIFORNIA

ABC INDUSTRIES

***AUTOMATIC TRANSFER SWITCH . . . "an emergency device which automatically and instantaneously transfers power load and lighting load circuits from a normal source to an emergency source of supply."**

ASCO Automatic Transfer Switches are carefully engineered, conforming to every safety code and employing the best materials available. They are not "mass production" items but a broad line of standardized assemblies which permits us to furnish the proper combination for any installation.

As an example of ASCO design and construction, consider the Automatic Transfer Switch illustrated. It's a 200 ampere, 750 volt maximum unit with Form E Relays with lockout relay on emergency and engine starting auxiliary contact.

Our Engineering Department will be glad to work with your engineers in studying your requirements in the way of Electromagnetic Controls such as: Automatic Transfer Switches, Remote Control Switches, Relays or Contactors. We have been doing this work for 60 years now.

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases.

Automatic Switch Co.

397 LAKESIDE AVENUE • ORANGE, NEW JERSEY

will decrease with increased hydrogen pressure at the same load. A reduction in the differential temperature between the hottest and coolest point in the machine can be expected.

5. Hydrogen loss will increase with higher pressure. These losses vary with different machines but the average loss with 15 psi should not be more than 3 times the loss on the same machine with 0.5 psi.

6. Operation of pumps is not noticeably different with higher or lower pressures.

7. With minor exceptions, the design and construction of hydrogen systems are not only adequate, but some simplification may be possible to the extent that improved seals may permit the future elimination of the so-called "iron horse" for gas detraining.

In addition to the above conclusions the survey brought to light two suggestions for caution. These are:

LEAKAGE. Hydrogen pressures higher than the cooling water pressure in the hydrogen coolers can result in a leakage of hydrogen into the cooling water with possible accumulation at unsuspected points in the cooling water system.

HIGHER PRESSURES. Some hydrogen cooling systems are equipped with an oil seal in the main oil tank. This seal is effective with 0.5 psi but must be valved off when higher pressures are used to avoid a dangerous accumulation of hydrogen in the main oil tank and its connections.

Reasons given for increasing hydrogen pressure above 0.5 psi fell generally into four classifications: (1) To reduce temperature at rated load, (2) to increase kilowatt output, (3) to increase kilovars available and (4) to increase kilowatts and kilovars. These reasons were nearly equally responsible for operating at higher hydrogen pressures; however, several additional reasons were given—in the form of comments—which are interesting:

(a) One unit was operated at higher hydrogen pressures to facilitate the maintenance of hydrogen purity.

(b) Another unit was operated with increased pressures to allow use of warmer water (condensate), this improving economy and avoiding use of corrosive water.

(c) A third unit increased hydrogen pressure to avoid objectionable

hum. The improvement was ascribed to reduction in temperature differential between parts of the armature.

The foregoing conclusions and comments are the results of 37 replies to 47 questionnaires circulated among EEI member companies represented on the Electric Equipment Committee. In all, the 70 machines listed in the replies totaled about 3,353,000 kw —an average capacity of 48,000 kw. Data was given on 31 machines operating at hydrogen pressures higher than 0.5 psi. A number of these were not complete. Hydrogen pressures ranged from 1.0 to 15 psi.

Magnetic Amplifiers*

L. W. BUECHLER, Bureau of Ships
U. S. Navy Dept, Washington, D. C.

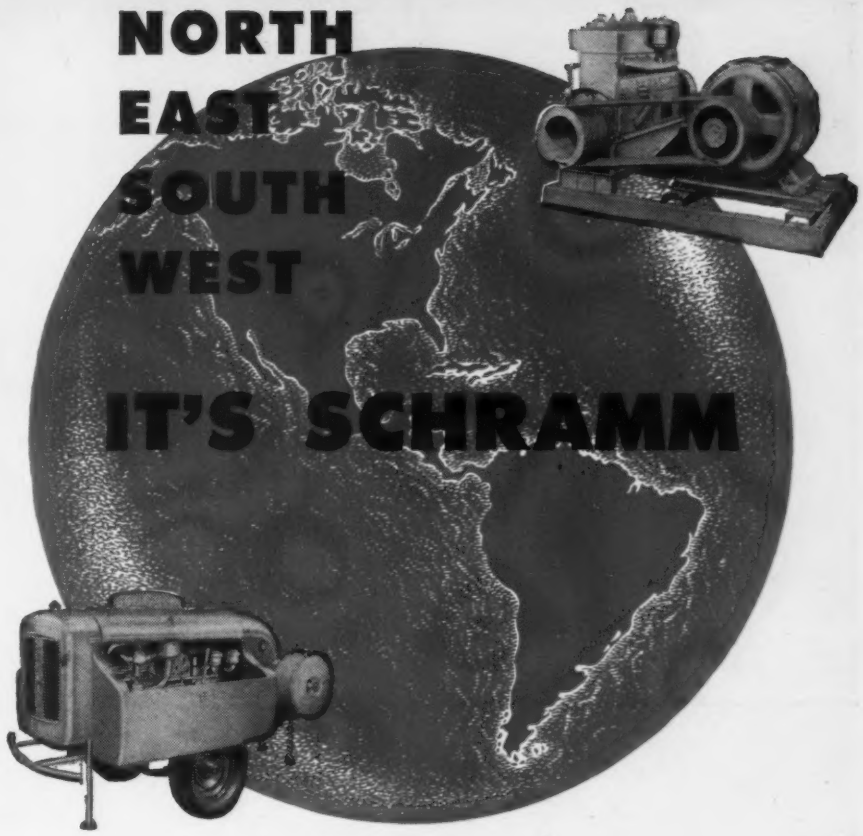
WITH MAGNETIC amplifiers (See ELECTRICAL WORLD Sept. 25 page 103) very high power amplification is possible. A power gain, that is, ratio of controlled power in load to power in control circuit, of 1,000,000:1 or even 100,000,000:1 per stage is possible. These ratios are not considered practical for most applications because of slow response which may range from one to five seconds.

For most applications in which a response of 1/200 to 1/10 of a second is desired, a power gain of 1,000-10,000:1 per stage is considered practical. An input control signal of from one milliwatt to a few microwatts is considered sufficient to control the first stage of amplification. Smaller control signals have been used but are not developed to the stage where they can be used generally.

Variable Time Response

The time of response can be made to meet most requirements. The time of response is usually measured in cycles of time referred to the a-c power supply. For power gains of 1,000-5,000:1, the time of response will probably be in the order of two to five cycles. This is dependent on the magnetic material and the circuits used. For 60-cycle power, the time of response will run from 1/10 to 1/30 of a second. If faster response is desired, 400-cycle power can be used and the time of response cut to about 1/200 of a second. Special higher fre-

* From a paper presented at the recent AIEE Middle Eastern District Meeting.



SO VERSATILE

. . . because Schramm can furnish air for any compressed air job in your work; and versatile because there is a size and model Schramm to fit your individual needs! Just specify the size you need.

SO EASY TO OPERATE

. . . merely by pushing a button to start, and compact and lightweight enabling you to move the portable units wherever you like! Meanwhile, the stationary units take up very little room, are vibrationless and no trouble!

SO ECONOMICAL

. . . because Schramm can do *all* your compressed air jobs quickly and efficiently. Features that assure economy include 100% water cooled, forced feed lubrication, and mechanical intake valve.

it pays to use Schramm!

Your field has found that Schramm Air Compressors well fit its needs. And has specified Schramm everywhere . . . North, East, South and West. Write today for full data.

TOOLS FOR THE JOB

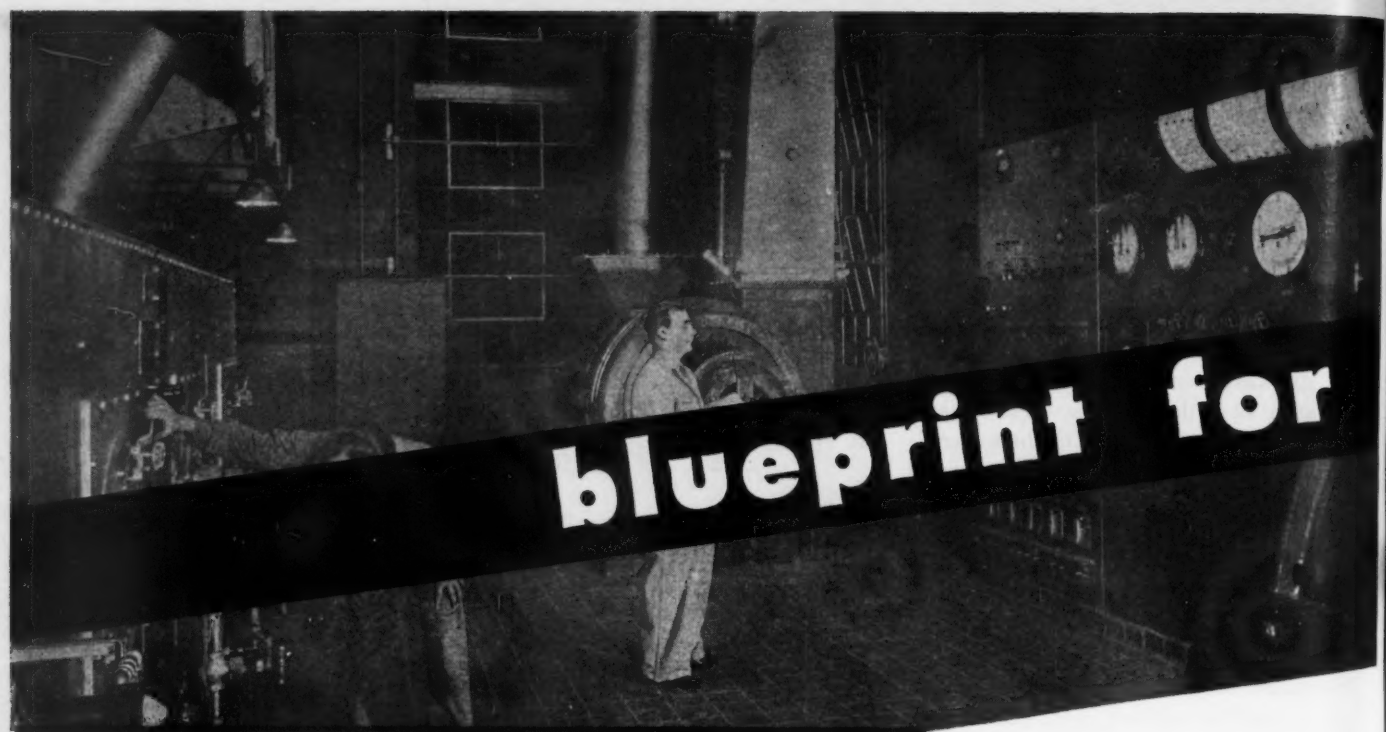
Schramm Inc. also has a complete line of Pneumatic Tools to offer and recommend for operation by their Compressors.

These include Rock Drills, Paving Breakers, Trench Diggers, Clay Spades, Backfill Tampers, Tie Tampers, Sheeting Drivers, Demolition Tools, Chain and Circular Saws.

Write for bulletins and prices.

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA



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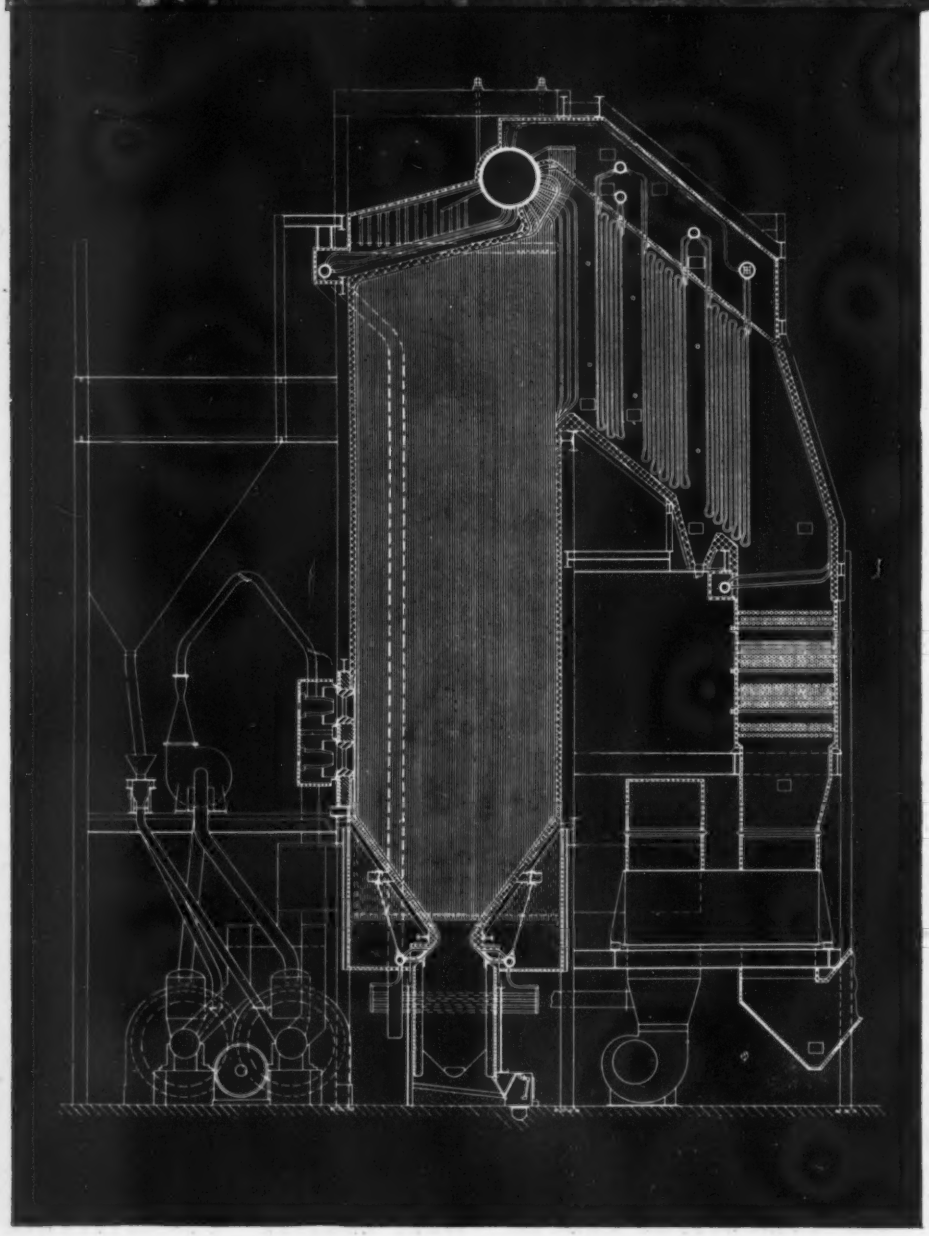


E. M. POSTON STATION
COLUMBUS AND SOUTHERN OHIO ELECTRIC COMPANY

Steam Capacity
425,000 lb per hr

Superheat control range
300,000 to 425,000 lb per hr

Pressure superheater outlet
1354 psi

Final steam temperature
955 F

Bituminous Coal Pulverized
in FW Ball Mills

ANNOUNCING...

SQUARE D *Electronic* CONTROL

FOR HIGH-PRODUCTION SPOT WELDING

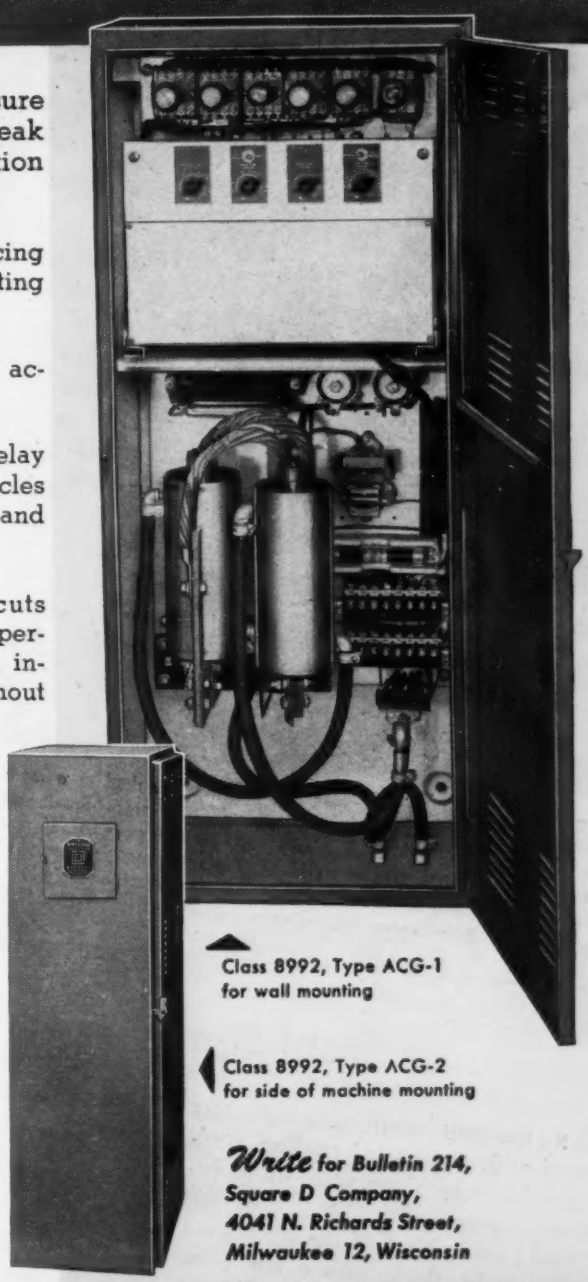
NON-SYNCHRONOUS COMBINATION UNIT . . . one enclosure houses an electronic contactor to make and break power circuit and a timer to govern weld duration and electrode motion.

SPEED • Up to 400 welds per minute. No sequencing relays. Simple six tube circuit cancels out operating delays of valve and firing relays.

ACCURACY • Regulated DC timing circuits insure accuracy over wide range of line voltage variations.

CONSISTENCY • Timing circuit coordinates firing relay operation to give consistent starting point and full cycles of welding current, thus avoiding high transients and transformer saturation.

LOW MAINTENANCE • Industrial construction cuts "down"-time, simplifies servicing. Disconnect plugs permit instant exchange of timer panels. Entire timer, including power supply, is removed in one piece without disturbing external connections. Two ¼ turn fasteners release swing-down panel making all components and circuit tie points instantly accessible at screw terminals.



Class 8992, Type ACG-1 for wall mounting

Class 8992, Type ACG-2 for side of machine mounting

The BEST Resistance Welder Control?

• There is no one type. Square D builds both magnetic and electronic controls of many types—each best suited to certain types of applications. Specify Square D, and be sure of getting the best for your job.

HIGH SPEED CONTACTORS

MOTOR DRIVEN TIMERS

Safront TIMERS

Electronic TIMERS & CONTACTORS

SYNCRO-BREAK CONTACTORS

SYNCHRONOUS-PRECISION COMBINATION CONTROLLERS

Write **for Bulletin 214, Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin**

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

LOAD BUILDING

Fluorescent Fixtures Replace Bare Lamps and Crystal

Elegant with crystal chandeliers and brackets, survival of a more ornate day, was the lighting in the Cotton Jewelers store. But it was not very efficient nor, in the eyes of the present generation, very beautiful, either. Then came the "Man Who Plans," emissary of New Orleans Public Service Inc, in promotion of the Planned Lighting Program. Before new fixtures were installed, the average light intensity was only 20 ft-c. Now intensity on merchandise has been raised to 40-60 ft-c. The amount of light is more than doubled with a power increase of only 45%, or 3.5 w per sq ft before to 5 w per sq ft afterward. The new lighting consists of two continuous rows of fixtures each containing four 40-w tubes, 8 ft 6 in apart, with 150-w R-40 spots between them

Steel Signs Baked With No Holding Time

AN EASTERN MANUFACTURER was faced with the job of coating steel-plate highway signs with white enamel, preparatory to applying "Scotchlite". Most of the signs were to be $\frac{3}{16}$ in. thick, with a few $\frac{1}{4}$ in. thick. It was considered desirable to coat both sides of the sign and bake in one infrared application. An air-drying primer was to be sprayed on first, followed by a very heavy coat of white enamel. Because of the thickness of the paint it was necessary to bake the sign in a horizontal plane. The optimum baking temperature prescribed by the paint manufacturer was 275 F.

Temperature Variation Small

The local power company made test runs to determine the temperature gradient in both thicknesses of steel sheet. The result was that the temperature difference between the top and bottom of a sheet of steel, when subjected to infrared heat from the top, was much less than anticipated. For the $\frac{3}{16}$-in. steel, when the top was at 110 F the bottom was 100 F. At 300 F there was but 5 degrees difference between top and bottom.

With the $\frac{1}{4}$-in. steel the temperature difference was greater between top and bottom. At 130 F for the top the bottom was at 100 F. When the top was at 280 F the bottom was at 268 F. As the temperature increased, the gradient between top and bottom decreased, as shown by the curves.

Preliminary samples were painted, baked and submitted to the manufacturers for comments. It appeared

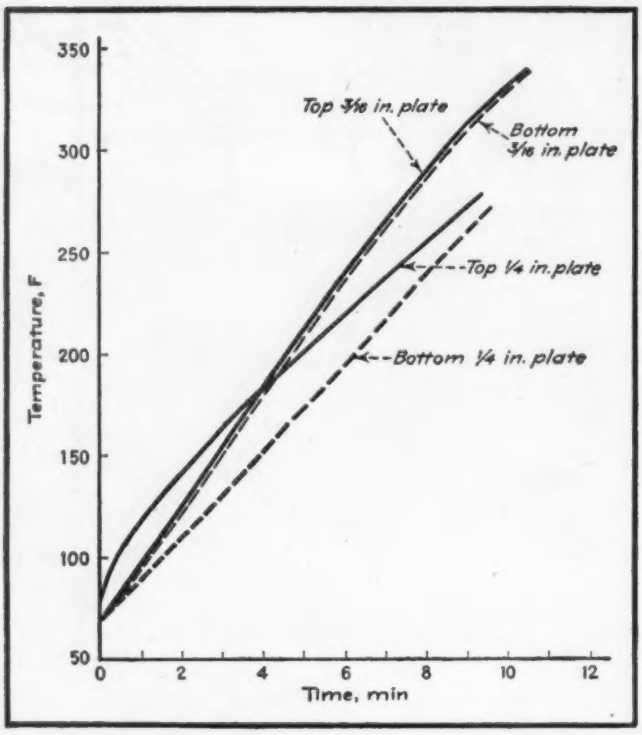
POWERS line construction and maintenance bodies

Your workshop on wheels

On the rough, tough jobs miles from home a POWERS Body makes completion of the job easier. Built and designed to meet field requirements, all the necessary accessories, tools, supplies and equipment are ever-handy for instant use... for any problem. Sturdy, all-steel construction provides unwavering, dependable service year-in, year-out, through all kinds of weather, over all kinds of terrain. For complete information write...

ALL-STEEL POWERS PUBLIC UTILITY BODIES

McCABE POWERS AUTO BODY CO.
5900 N. BROADWAY • ST. LOUIS 15, MO.
OVER 75 YEARS EXPERIENCE



Time For Heating Steel Plates by Infrared Lamps

1/4-in. thick plate		3/16-in. thick plate	
Time, min	Temperature, top of plate, F	Time, min	Temperature, bottom of plate, F
0	70	0	74
0.5	95	0.5	80
1.0	108	1.0	93
1.5	118	1.5	105
2.0	128	2.0	117
2.5	136	2.5	130
3.0	145	3.0	144
3.5	153	3.5	158
4.0	163	4.0	171
4.5	172	4.5	185
5.0	183	5.0	200
5.5	190	5.5	213
6.0	200	6.0	225
6.5	209	6.5	238
7.0	216	7.0	250
7.5	225	7.5	261
8.0	233	8.0	273
8.5	241		
9.0	250		
9.5	260		
10.0	265		
10.5	273		
11.0	280		
11.5	286		
12.0	293		
12.5	298		
13.0	305 (Bottom, max. 285 F)		

Plates were pickled to remove scale; primed, and sprayed on both sides with white enamel paint. Heating was by one bank of infrared lamps, 10 w per sq. in. output.

INFRARED HEAT applied to one side in typical test showed satisfactory baking of paint on both sides of highway sign

that they desired to restrict the baking cycle to a single application of radiant energy from the bank of lamps, omitting the usual "holding time" at the optimum baking temperature. The remaining tests determined how long full heat had to be applied to develop the optimum baking temperature of 275 F on the bottom of the sign.

The runs shown in the table resulted in a satisfactory bake for both top and bottom of sign plates. The baking cycle consisted of heating by use of a 10-w per sq in. input bank of infrared lamps. Total heating time for a $\frac{1}{4}$-in. plate was 13 min. The resulting quality of both top and bottom coats of paint was excellent. The maximum temperature reached by the bottom of the plate was 285 F. In another run, it was found that a satisfactory bake could be obtained with $\frac{3}{16}$-in. steel by using a 10-w per sq in. bank for 8 min. Maximum bottom temperature reached was 273 F.

The tests showed that satisfactory baking of paint by using infrared can be obtained in some applications by merely heating the paint to the optimum baking temperature and then immediately cutting off the source of radiant heat. There is no need for optimum temperature "holding time".

Induction Motor Performance Characteristics

Code: Inc —increase, Dec —decrease, N.C.—no change		Starting & Maximum Running Torque	Synchronous Speed	Percent Slip	Full Load Speed	Efficiency			Power Factor			Motor Current, amp		Temp Rise, C
						F.L.	¾	½	F.L.	¾	½	Full Load	Starting	
Voltage Variation	120%	Inc 44%	N.C.	Dec 30%	Inc 1.5%	Small Inc	Dec ½–2	Dec 7–20%	Dec 5–15%	Dec 10–30%	Dec 15–40%	Dec 11%	Inc 25%	Dec 5–6
	110%	Inc 21%	N.C.	Dec 17%	Inc 1%	Inc ½–1%	N.C.	Dec 1–2%	Dec 3%	Dec 4%	Dec 5–6%	Dec 7%	Inc 10–12%	Dec 3–4
	Function	Voltage²	Constant	$\frac{1}{\text{Voltage}^2}$	Syn. Speed –Slip								Voltage	
	90%	Dec 19%	N.C.	Inc 23%	Dec 1½%	Dec 2%	N.C.	Inc 1–2%	Inc 1%	Inc 2–3%	Inc 4–5%	Inc 11%	Dec 10–12%	Inc 6–7
Frequency Variation	105%	Dec 10%	Inc 5%	N.C.	Inc 5%	Slight Inc			Slight Inc			Slight Dec	Dec 5–6%	Slight Dec
	Function	$\frac{1}{\text{Frequency}^2}$	Frequency		Syn. Speed –Slip								$\frac{1}{\text{Frequency}}$	
	95%	Inc 11%	Dec 5%	N.C.	Dec 5%	Slight Dec			Slight Dec			Slight Inc	Inc 5–6%	Slight Inc

EFFECT OF CHANGE IN VOLTAGE AND FREQUENCY on induction motor performance. Prepared by D. O. Bergey, Pacific Power & Light Co from General Electric data for use of power salesmen in answering customers' questions and handling complaints. Note: Starting and maximum running torque varies as square of voltage; % slip varies as 1 divided by frequency squared; starting current varies as 1 divided by frequency. Code: Inc — increase; Dec — decrease; N.C. no change

NEW! FLUORESCENT Sun Lamps

This fluorescent sun lamp, the most powerful ever produced, provides a means of bathing wide areas with beneficial ultraviolet light.

In appearance the lamp looks like a regular fluorescent lamp. Its rays are soft and diffuse so that it can be mounted overhead for uniform and economical room irradiation. A newly developed phosphor powder, which generates the healthful energy, is used to coat the inside surface of the ultraviolet transmitting glass.

Wide Variety of Applications

The new lamp's efficiency is five times that of the screw-in bulb-type sun lamp. Thus it is ideal for use in schools, factories, offices, mines, and underground industries. In such places, it provides beneficial ultraviolet, similar to that in natural sunshine.

It is also usable for suntanning. An exposure of approximately five minutes to a 40-watt sun lamp, mounted in a suitable reflector two feet away, is sufficient for a tan. This feature will appeal to operators of gymnasiums, hospitals, solaria, barber and beauty shops.

Uses Standard Accessories

The lamp is available in 20- and 40-watt sizes. The dimensions and electrical characteristics are the same as those for the present Westinghouse fluorescent lamps of the same ratings. Consequently the new sun lamps can be operated in standard fluorescent fixtures.

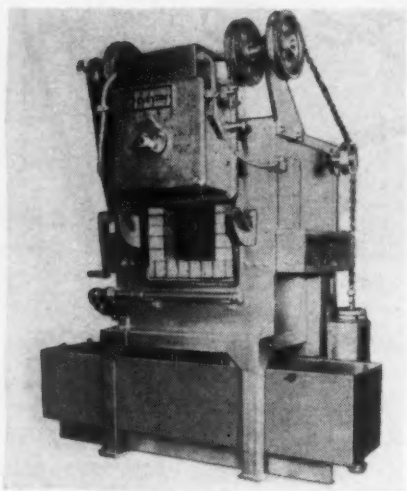
For more information about the new Westinghouse sun lamp, write Lamp Division, Westinghouse Electric Corp., Bloomfield, N. J.

TECHNICAL DATA

	20-WATT LAMP	40-WATT LAMP
Bulb diameter	1½"	1½"
Lamp Length	24"	48"
Operating Amperes	0.36	0.415
Operating Volts	60	106
Base	Medium Bipin	Medium Bipin
Rated Avg. Life	2500 at 3 hours/start 4000 at 6 hours/start	2500 at 3 hours/start 4000 at 6 hours/start

YOU CAN BE SURE...IF IT'S Westinghouse

NEW EQUIPMENT



Hearth Furnace

DESIGNED FOR HARDENING small parts, a continuous flow vibrating hearth furnace is now manufactured by Lindberg Engineering Co, 2444 West Hubbard St, Chicago 12, Ill. Pieces within the furnace move by high frequency vibration rather than by intermittent abrupt impulses. There is neither perceptible hearth movement nor jarring of furnace equipment, it is claimed.

The furnace is provided with either an oil or salt quench. Operating temperatures to 1800 F are obtained electrically using nickel-chrome heating elements.

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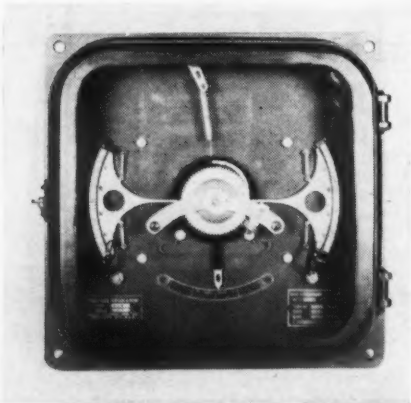

Regulator Damping System

A NEW electrical damping system reported to provide increased sensitivity, quick response and ease of adjustment has been developed for the rocking-contact torque-motor type generator voltage regulator, according to Allis-Chalmers Mfg Co, Milwaukee, Wis.

This electrical damping mechanism is a seperate assembly designed for rear-of-board or remote mounting. It consists of derivative transformers and a magnetic amplifier. No restriction is placed on the regulator to prevent undesirable voltage swings.

This damping system is made up entirely of static components which are operated well below their capacity. The volt-ampere burden of the regulator on the potential transformers is said to have been reduced more than 50% by the new damping system.

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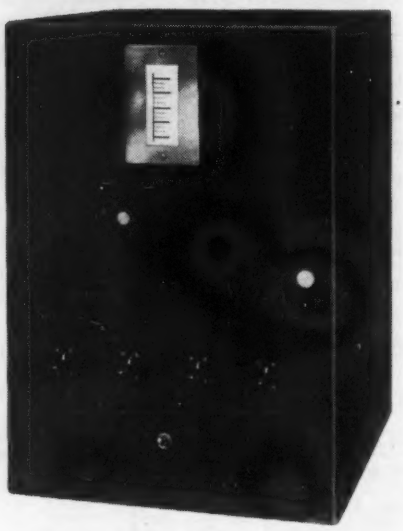
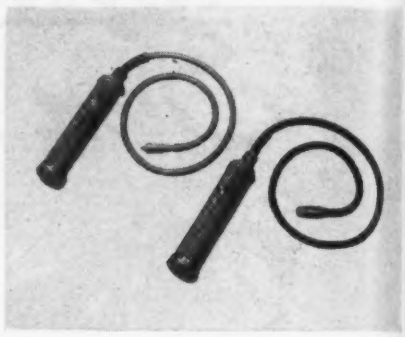


Three-Channel Indicator

A PRESSURE measuring system with three 72-in. scales has been placed in production by Automatic Temperature Control Co, Inc, 5212 Pulaski Ave, Philadelphia 44, Pa.

Known as "Atcotran" 3-channel indicator, it accommodates pressure measuring cells such as Bourdon tube, bellows or differential bellows for flow. The three bands are selected from switches on the front of the case. Each scale is said to move full range in less than 2 sec. By depressing any two selector switches the difference between two points of pressure can be read in 1 sec.



Flashlight Extension

TUBINGS to provide flexibility of flashlights and introduce light into hard-to-get-at places have been developed by Aero-Motive Mfg Co, 1803 Alcott St, Kalamazoo 24, Mich.

Three new forms of flexible extensions in 9, 18, 36 and 61-in. lengths are: Neoprene insulated type for use around electrical equipment; flexible steel armor to stand abrasion as in working with boiler tubes and deep cylinders; woven braided metallic shielding for general purpose work as in inspection and repair of light machinery.

Extensions are available on Junior Deluxe Model 55 Flex-Lite which uses two penlite batteries, and Master model 75 powered by two D type large cells.

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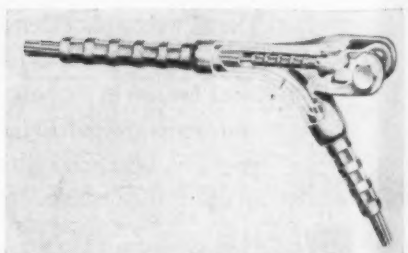


Compression Dead-End

FOR ATTACHMENT to the insulator string on a tower, a compression type dead-end fitting has been developed by Thomas & Betts Co, Elizabeth, N. J. Installation is made with a hydraulic tool that can be transported in pack bundles on a man's back. The fitting features compressions both in the main cable and jumper loop.

The manufacturer points out that its new dead-end furnishes a continuous, high conductivity path for the current

HUBBARD GUY CLAMPS

1. The *straight groove* eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand. Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

2. The *straight groove* fits any and all twists, right or left hand and a variation in diameter without *creating* any high spots to *lessen clamping area.*

3. Bell-end grooves prevent injury to the strand caused by the sharp corners at the ends of the grooves of some clamps.

4. High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used—HUBBARD DOUBLE-DIP HOT GALVANIZING.

5. The range of strand sizes accommodated by No. 7461 Guy Clamp, without sacrifice of holding strength in any size, can not be matched by any other style of clamp. Exhaustive tests have been made on specially designed clamp sections, patented shapes and various snubbing ideas, all of which have failed to measure up to the HUBBARD straight, smooth groove type of clamp.

HUBBARD AND COMPANY

PITTSBURGH CHICAGO **OAKLAND, CALIF.**

STOP FIRE FASTER!

WITH THE MASTER OF FLAME ANSUL® FIRE EXTINGUISHING EQUIPMENT

ANSUL MODEL 350 A

DRY CHEMICAL

FIRE EXTINGUISHERS

MORE AND BETTER FIRE PROTECTION FOR YOUR FIRE EXTINGUISHER DOLLAR

Ansul Dry Chemical Fire Extinguishers give you more protection . . . pound for pound . . . dollar for dollar . . . than any other extinguisher of comparable size.

In addition . . . Ansul Fire Extinguishers provide the best first-aid protection:

- **For electrical equipment hazards . . .**
  TRANSFORMERS, GENERATORS, CIRCUIT BREAKERS, MOTORS, ETC.

Ansul Fire Extinguishers have the highest established ratings for effectiveness on flammable liquid fires, based on tests by nationally recognized approval agencies. The longer range stream of dry chemical is effective in winds and drafts.

After use, Ansul Dry Chemical Fire Extinguishers can be recharged "on the spot" . . . providing continuing protection . . . and annual recharging of Ansul extinguishers is NOT necessary.

Safe to use . . . non-toxic, non-corrosive, non-abrasive.

Ansul Dry Chemical Fire Extinguishers are preferred fire protection in the utilities field and for electrical equipment hazards in all industries.

Ask for your copy of file No. 204. You will receive factual data on how Ansul Dry Fire Chemical Extinguishers will cut your fire protection costs.

Listed and approved by Underwriters' Laboratories and Factory Mutual Laboratories.

Ansul Model 30

Ansul Model 20

Ansul Model 4

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN ALL PRINCIPAL CITIES

as one aluminum tube holds both main cable and jumper loop. Conductance is said to be higher than the conductance of the same length of cable.

An aluminum sleeve holds the aluminum strands. A stainless steel clevis grips the steel core. A neoprene gasket in a tapered hole seals out external atmosphere at the breech; compressions and No-Ox-Id seal out the ambient atmosphere at the muzzle and at the butt.

•

Earth Drill

A NEW hydraulically controlled earth drill, model HBJ, is announced by the Buda Co, Harvey, Ill. It drills 6 in. to 42 in. dia holes to depths of 16 ft.

Features of the drill are engineered for power pole line construction, convenient transporting and minimum "set-up" time for digging. Finger tip controls permit adjustment of drill head to a vertical position and leveling adjustments are provided for either straight holes or anchor holes.

The drill is available with a factory installed tower extension and winch for setting poles up to 45 ft in length. It is powered by a slow speed 4-cylinder Buda gasoline engine. The engine, together with the drilling mechanism, is mounted on an I-beam of structural steel. A flat-bed truck or a heavy 4-wheel trailer is recommended for mounting the packaged unit.

•

Emergency Lamp

AN EMERGENCY LAMP called Big Beam 400-F has been developed by U-C Lite Manufacturing Co, 1050 West Hubbard St, Chicago, Ill. Mounted in a baked enamel steel container, the lamp operates on standard 6-v dry-cell batteries to produce either a flashing or steady light reported to be visible for

One of the busiest lines in your business

The line of trucks you use in construction, maintenance, or trouble-shooting, carries a big responsibility. It's a mighty busy line.

We appreciate that.

That's why International Trucks are built, sold and serviced with these three things in mind:

1. Rugged truck construction—the built-in stamina to give users dependable day-in-and-day-out service under any conditions and at lowest possible cost.

2. Specialized trucks for any job—International builds 22 basic models, offers more than 1000 truck combinations, provides trucks with gross weight ratings ranging from 4,400 to 90,000 pounds. That means you can get the *right* truck for *any* of your jobs, from International.

3. Quick, complete service anytime, anywhere—International has built up the nation's largest exclusive truck service organization. 4,700 Dealers and 170 company-owned Branches stand ready to pitch in to keep International Trucks rolling. Precision-engineered replacement parts, factory rebuilt exchange units, special tools and factory-trained mechanics . . . these are all part of International service. That service backs up every International Truck you drive.

A rugged line, a complete line, a well-serviced line . . . that's the line of trucks International offers for one of the busiest lines in your business. A call to your nearest International Dealer or Branch will get you all the facts and figures, *fast!*

Tune in James Melton and "Harvest of Stars," CBS, Wednesday evenings

INTERNATIONAL TRUCKS

MOTOR TRUCK DIVISION • INTERNATIONAL HARVESTER COMPANY • CHICAGO

Special delivery for Joe the Rigger
. . . the order specified Crosby Clips.

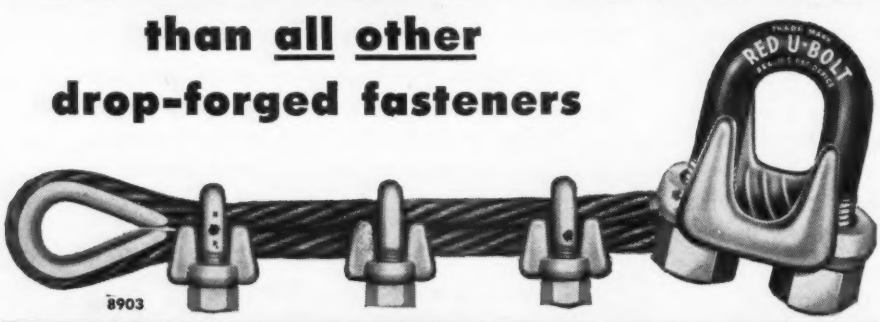
For any job where *safety* counts—CROSBY CLIPS! For rigging cranes and derricks . . . connecting swing cable . . . guying poles and towers—CROSBY CLIPS. They're hot dip galvanized, and drop-forged. High side wings and channel grooved base assure perfect lay of the rope. And CROSBY CLIPS hold with a *vise-tight* grip. Sizes for wire rope from ⅛ inch to 3 inch. Sold by distributors everywhere. Made only by AMERICAN HOIST and Derrick Co., St. Paul 1, Minnesota.

Industry uses more

CROSBY CLIPS

than all other

drop-forged fasteners



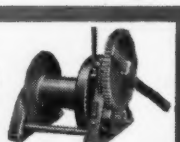
8903

For Armored Construction . . . specify

AMERICAN BLOCKS AND SHEAVES

●A complete line of wire rope blocks—all types, all sizes, in capacities from 1½ to 250 tons. Thick steel side plates, heavy pins and axles. Ask for American equipment when ordering.

ONE MAN LIFTS 10,000 LBS. WITH THE AMERICAN HANDIWINCH

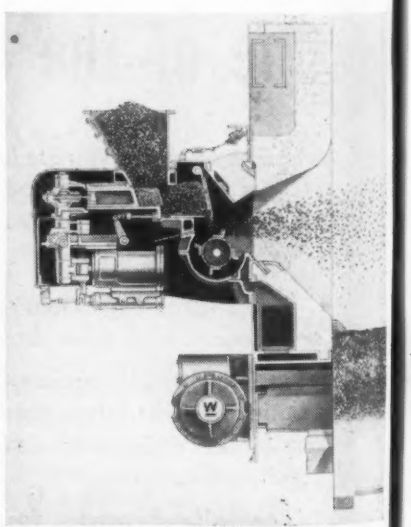


●Gives one man the power of a crew. Weighs only 95 lbs. Handles lifting, loading and pulling jobs up to 5 tons. All steel construction. Ask your distributor.

distances of 600 ft or over.

Ordinary battery life is said to give 112-120 flashes per minute continuously for 28 hr or steady burning for 20 hr. Two bulbs on independant circuits are used in normal operation and a spare bulb is included in the unit. The lens of molded plastic, available in colors of red, clear, blue or amber, screws into the container top against a rubber gasket. This emergency lamp meets I. C. C. specifications.

•



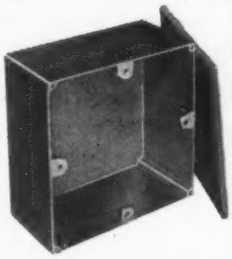
Spreader Stoker

ECONOMICAL combustion of any grade of coal, even lignite, is reported possible with the Centrafire spreader-type industrial stoker announced by Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa.

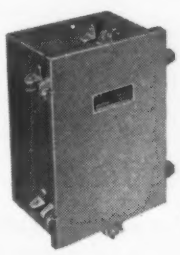
In the new stoker, coal is trajected by an air-cooled, hydraulic motor-driven rotor so that it falls evenly over the entire length of a Westinghouse Link-Grate. Undulation of the central grate keeps the fuel bed active and moving toward the ash discharge grates at the

O.Z. cast iron boxes

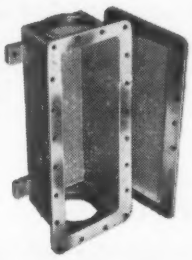
COMPLETE LINE • COMPLETE LINE • COMPLETE LINE COMPLETE LINE



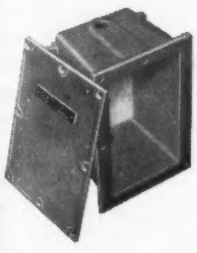
TYPE Y1200
Unflanged junction box with cover. Flush or Surface mounting.



TYPE Y3200
Weatherproof pull box. Complete with one-piece rubber gasket and hinged cover; surface mounting.



TYPE Y6000
Explosive resisting junction box designed in accordance with Underwriter's Laboratory requirements. Cover and flange are accurately machined and correct bolt spacing provided. Flush or Surface mounting.



TYPE Y8000
Flanged watertight box with cover complete with rubber gasket. Flush or Surface mounting.

5214

When you specify O. Z. Cast Iron Boxes for industrial, railroad, airport, oil refinery and other heavy-load circuits, you specify the best. Cast from close-grained, grey iron, these sturdily constructed boxes are accurately machined to your requirements and then hot-dip galvanized to provide maximum corrosion resistance.

No matter what the operating condition . . . explosion resisting, watertight or weatherproof . . . you'll find a box to fit the job in O. Z.'s complete line. All boxes can be supplied with or without bosses or mounting lugs and are drilled for conduit entrances as required.

For detailed information on O. Z.'s Cast Iron Boxes as well as 150 other electrical fittings, write for our catalog.

- CAST IRON BOXES
- SOLDERLESS CONNECTORS
- CONDUIT FITTINGS
- CABLE TERMINATORS
- GROUNDING DEVICES
- POWER CONNECTORS

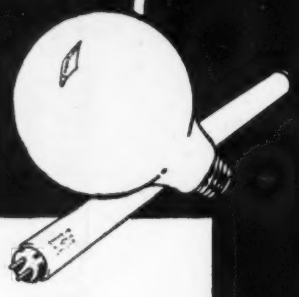
Buy O. Z. and you'll see why Engineers say,

"They're OK If They're O. Z."

O.Z. ELECTRICAL MANUFACTURING COMPANY, INC.

262 BOND STREET · BROOKLYN 2, N. Y.

It's a good plan for you to put these three planks in your planned lighting platform



1. **Champion Fluorescent and Incandescent Lamp Quality.** When you standardize on lamps bearing the Champion diamond mark you can be certain of the best light for your money. Champion Lamps are guaranteed to equal or exceed Federal Specifications — backed by one of the oldest and largest manufacturers in the business.

2. **Champion Industrial Lighting Service** — trained experts in the field to give you unbiased recommendations on lighting and lamp applications to meet your individual requirements.

3. **Champion Industrial Distribution**—Champion Lamps are available in your locality through electrical or industrial supply houses that know your needs and are qualified to give you prompt, intelligent, low cost service. There's no better, more efficient or more economical way to buy lamps.

Let us mail you a copy of the Champion Maintenance Manual M. It's full of useful hints on how to make the most of *planned lighting.*

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

sides. Ashes are discharged from the furnace without interrupting the coal feed, reducing load or loss of steam pressure.

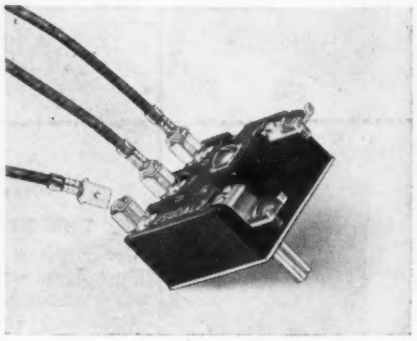
A deficiency of primary air rising through the central Link-Grate is deliberately maintained. Resulting monoxides are burned in a turbulent secondary air supply above the trajectory of incoming fuels. An increased supply of the metered primary air is admitted through the side areas of the grate and ash-discharge grates to provide complete combustion.

Coal is fed to the rotor by two long-stroke, slow-speed rams. A coal-feed equalizer plate driven from the rotor oscillates across the incoming fuel to assure a continuous feed whether the coal is wet or dry.

•

Plug-in Terminal

A DISCONNECT TERMINAL designed to speed the wiring of electrical equipment has been developed by the Ark-Les Switch Corp, 51 Water St, Watertown 72, Mass. A flat blade, staked to the connecting wire, snaps into a rigid receptacle in which it is retained by



spring pressure. Low contact resistance is assured by the flat terminal construction which provides large-area contact surface—¼ in. x ⅜ in. Both contacts can be furnished in brass, stainless steel or monel metal.

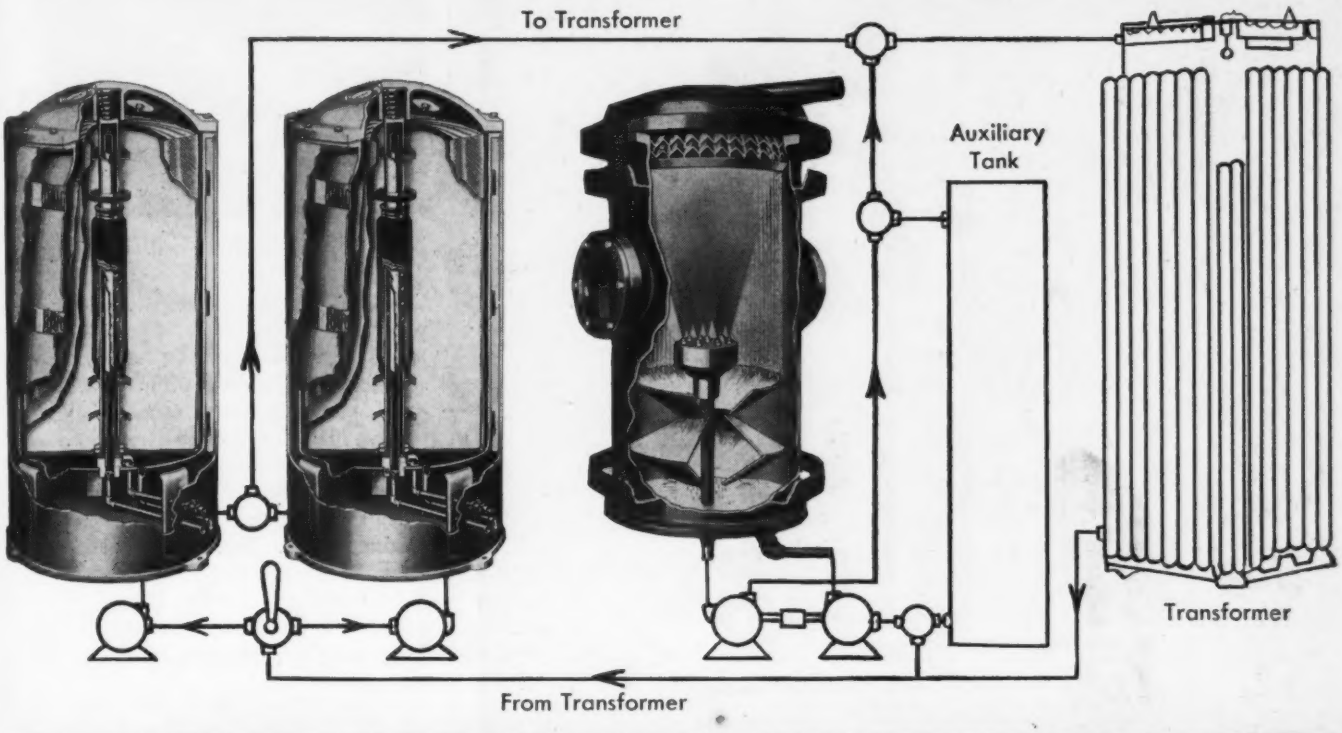
The terminal assembly as illustrated is listed at a rating of 20 amp, 125-250 v a-c.

•

Fluorescent Fixture

PARTICULARLY SUITED for buildings with moderately high ceilings, the slimline fluorescent lighting fixture CSL-496 has been designed by Sylvania Electric Products Co. The unshielded unit, utilizing four T8 lamps which consume a total of 204 w, can be installed surface or pendant mounted, either individually or in rows.

It is reported that the blunt end chassis design, replacing a tapered chassis, will eliminate shadows when the units are mounted end to end. A metal



The New Houdaille* Purivac

Engineered to provide the utility and performance Utility Technologists prefer for both field and central station purification of insulating oils

*Pronounced Hoo-dye

Re-conditioning deteriorated insulating oil leads to significant savings—especially with the new Houdaille Purivac unit.

It alone has the flexibility needed for field conditioning. Dual adsorbent purifiers operating individually, in parallel or in stages insure maximum economy—either in field or central station operations.

Dehydration and degasification are capably performed by an automatic vacuum unit. In it thousands of tiny droplets are produced by the atomizers to insure rapid, efficient dehydration—eliminating the need for high, surface temperature heaters.

With an entirely separate dehydrator, operation is independent of the purifiers. Thus, dehydration may be started when desired—during purification, afterwards or without prior treatment.

Today—conservation and economy—are more important than ever before. Here is an opportunity to conserve oil and effect real economies by extending the useful life of your insulating oil—benefiting at the same time from reduced maintenance costs as units are kept sludge-free.

Write today for further information about this versatile equipment. Without obligation, you may have a sales engineer call to present the facts about the Houdaille Purivac . . . and its application to your conditioning requirements.

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In the field of electronics and the electrical goods industry, MOSINEE stands for paper-base processing materials with scientifically controlled chemical and physical properties, high quality standards and dependable uniformity . . . with good dielectric strength, high tensile or tear strength; proper softness or stiffness; creped with controlled stretch or flexibility; specified pH for maximum-minimum acidity or alkalinity; accurate caliper, density, liquid repellency or absorbency . . . or other technical characteristics vital to your quality standards and production requirements.

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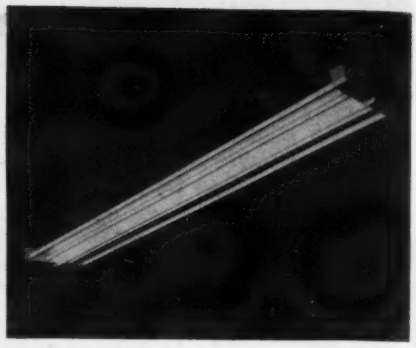


band supplied with each J-fixture is the only joining part necessary. In addition, the fixtures can be serviced or relamped without removing or disturbing end caps and joining bands.

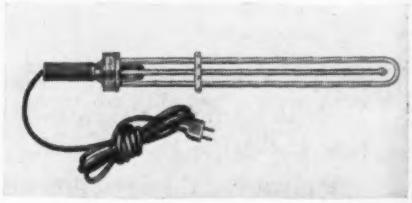
Although 4500-deg white lamps are provided, Warmtone or other colors can be specified for the fixture. Both reflector and chassis are finished in white Miracoat, while a scuff-proof aluminum finish has been applied to end caps and joining bands. Each fixture is 98 in. long.

•

Immersion Heater

AN AUTOMATIC immersion heater with adjustable thermostat control is being marketed under the name of Chill-Chaser and is made by Still-Man Co, 433 East 146th St, New York 56, N. Y. Applications are for heating liquids in tanks, kettles and tumblers.

Thermostat is said to maintain temperature to within one deg F. A safety cut-out prevents element from overheating or burning out when out of solution.



Five immersion lengths, 5, 8, 10, 15 and 20 in. are available in acid resisting stainless steel. The units are rated at 1000 w, 110 v, a-c.

•

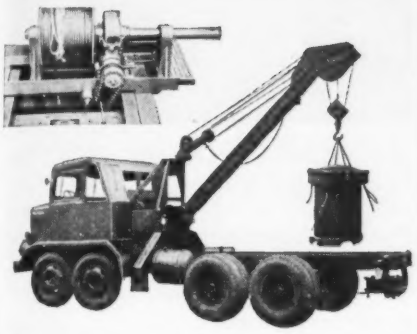
Starting Switches

A NEW LINE of manual starting switches for use with fractional-horsepower motors has been announced by Control Division of General Electric Co, Schenectady 5, N. Y. The new switches are furnished in five different types: with general-purpose enclosure; without enclosure; a combination unit and selector switch; with cast iron enclosure for wet locations, and a similar type for dusty or hazardous locations.

One feature of all five types is a

SILENT HOIST & CRANE CO.
Pioneer Mfrs. of Equipment For Public Utilities

KRANE KAR Swing Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.

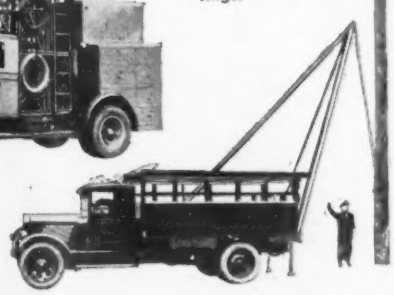


WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.



USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:

No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

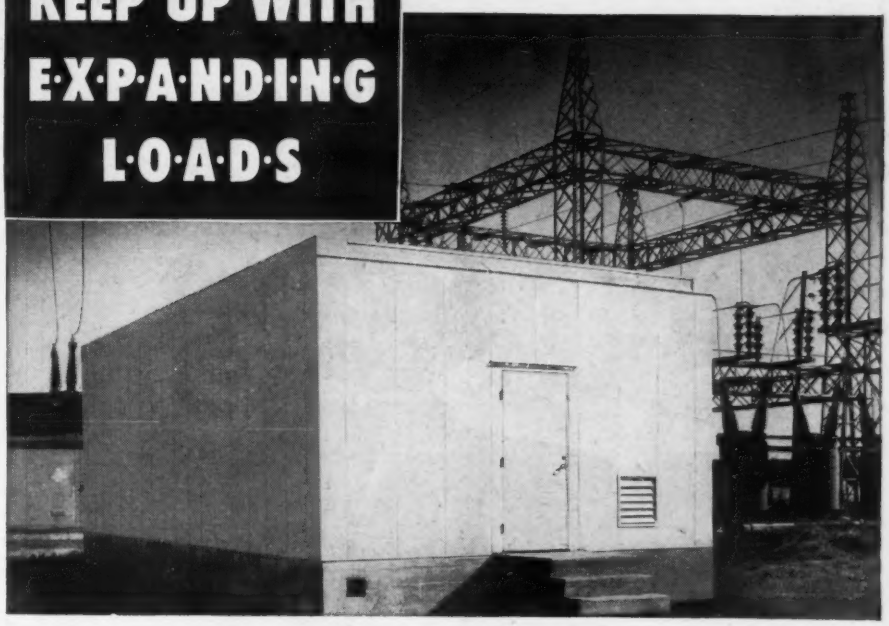
2½, 5, AND 10 TON CAPACITIES

KRANE KAR

TRADE MARK REGISTERED

SILENT HOIST & CRANE CO.
862-63rd ST., BROOKLYN 20, N. Y.

KEEP UP WITH E·X·P·A·N·D·I·N·G L·O·A·D·S



Erect BUTLER Unit Substations IN A FEW DAYS–AT LOW COST

SAVE on Construction and Maintenance Costs with BUTLER Boulevard Substations

- Patented Key-Lock Device Locks Steel Panels Together Into Strongest of Structural Systems
- First Quality Steel Sheet Panels
- Easily Insulated at Time of Erection
- Clean, Attractive Appearance
- 4 Standard Sizes: 16'x30', 16'x20', 16'x16', 8'x12'

COMPLETE LINE OF BUTLER STEEL-BUILDINGS

Adaptable to Hundreds of Electrical Uses

3 other construction styles, unit widths from 6 ft. to 60 ft., lengths variable. Widely used in the electrical industry.

Electric power suppliers are meeting rapidly expanding loads in residential, business, industrial and rural areas with Butler unit substations. They find definite savings—first, in initial cost because Butler substations are factory-fabricated. Again, in speedy erection. Time and construction costs are lower. Maintenance costs are always at a minimum.

Use these attractive buildings as unattended substations, or as CAX buildings. For warehouses, materials depots, machine shops, etc., there are many other adaptable styles of Butler buildings to choose from.

See your nearest Butler dealer or distributor, or mail coupon today for complete information.

BUTLER *Boulevard* **BUILDINGS**

BUTLER MANUFACTURING COMPANY

Factories: Kansas City, Mo. Galesburg, Ill. Richmond, Calif. Minneapolis, Minn.

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It's YOUR Life!

Be absolutely safe with

Buckingham

INDUSTRIAL SAFETY SEAT

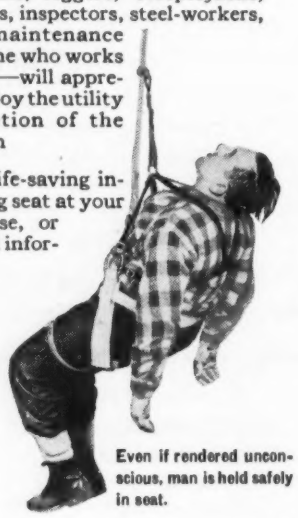
Greater freedom of movement . . . added comfort . . . and sure protection against falling from the seat, whether conscious or not—rigging workers have all these advantages in the BUCKINGHAM Safety Suspension Seat.

The picture shows how the load is carried by the heavy wrought iron hook. The rigid wood seat, which cannot become dislodged while in use, provides more comfortable support for the worker, preventing the binding and constriction encountered in rope or strap slings. Leg straps keep the 5¾" seat always in proper position.

Use of the chest harness makes it impossible for the man to topple from this suspension seat, either from vigorous movement, or from loss of control through sudden illness, accident, sunstroke, gas fumes. The safety cord, fastening to the carrying rope or cable above the worker's head, keeps the user's body approximately in normal position in event of emergency . . . yet does not interfere with customary activity.

Electricians, riggers, steeplejacks, tree surgeons, inspectors, steel-workers, painters, maintenance men—anyone who works from a sling—will appreciate and enjoy the utility and protection of the Buckingham

See this life-saving industrial sling seat at your supply house, or write for full information.



Even if rendered unconscious, man is held safely in seat.

BUCKINGHAM MANFACTURING CO., INC.

Binghamton, N. Y.

molded base of moisture-resisting insulating material which mounts and encloses the mechanisms and contacts. This particular construction serves to protect the operating parts from dust

and physical contact, and directs the heat concentration to bimetallic tripping device. Another feature is the action of the switch handle, which moves to the "off" position on overload, thus giving positive indication that the power is shut off.

The wheel-type movable contact cleans as it rolls against the stationary contacts, and, in addition, recedes into a recess in the base, thus snuffing the arc.

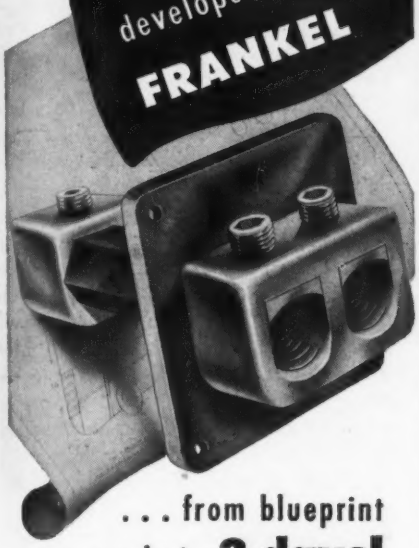
•

Shunt Capacitors

THE LINE of Elemex shunt capacitors now have treated, stainless steel tanks and include both 15 and 25-kvar sizes, according to an announcement by Line Material Co, Milwaukee 1, Wisconsin.

Same elevation of terminals above

special connector developed by FRANKEL



. . . from blueprint to sample in **3 days!**

Unusual wiring problem required a special connector never before developed. These rigid specifications had to be followed:

Connect two 2/0 flexible cables and one 2/0 flexible cable, end to end . . . carry 300 amperes at 12 volts with negligible voltage drop . . . withstand extreme vibration without loosening . . . design connector so that a vapor-tight insulating support could be molded around connector body.

FRANKEL engineering quickly solved this difficult problem. The connector shown above was accepted after testing for voltage drop and vibration.

need special connectors?

FRANKEL'S compact, integrated organization can quickly handle your toughest connector requirements. Complete facilities under one roof for:

- **DESIGN and DEVELOPMENT**
- **TOOL and PATTERN MAKING**
- **MACHINING and STAMPING**
- **FOUNDRY (casting in electrical bronze and special non-ferrous alloys, such as: guaranteed high conductivity copper, aluminum bronze, manganese bronze.)**

Send us your connector problems for development and your blueprints for quotation. Prompt, confidential service assured.

FRANKEL CONNECTOR CO.
27 VESTRY STREET • NEW YORK 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS

4353

DON'T FORGET to see the newest ways of cutting costs— at the . . .

18th NATIONAL POWER SHOW

NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

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Management International Exposition Co.

See over 300 technically-staffed exhibits and first-hand demonstrations of the very latest advances in equipment, materials and methods for efficient, economical power production and use of steam, electric and mechanical power. Talk with engineering specialists on hand to help with your present problems and future plans. Get ideas on design, installation, operation and maintenance you can profitably use now and later. It will be time well spent. Remember the date: plan to come: bring your associates.

SAVE MONEY!

Flexibal wooden guy guards cost less than other types — give full protection longer.

SAVE TIME!

7 foot Flexibal guy guard takes just 2 minutes to install — then lasts for years.

Put Flexibal guy-wire guards on your standards list . . NOW!

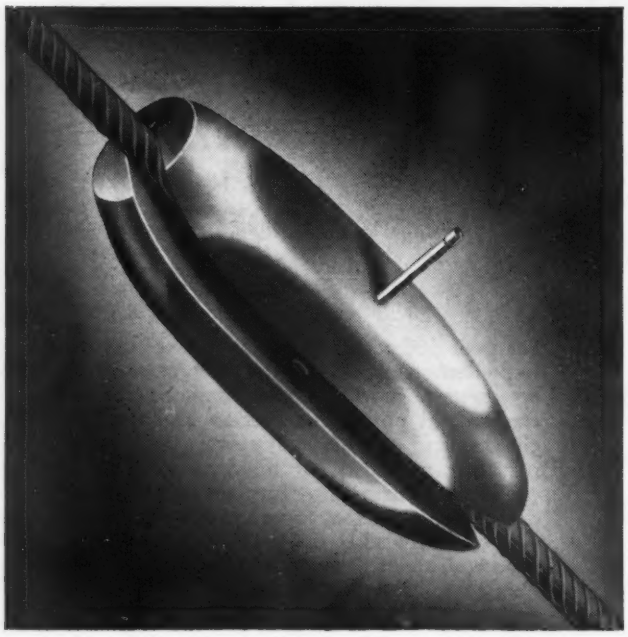
Every organization that has standardized on Flexibal guy guards has continued their use. Made of smoothly rounded hardwood and aluminum coated for lasting visibility, Flexibal guy guards provide flexible, lasting protection. They're packed in small easy-to-carry cartons, and there's only one nail to drive. May we send you free trial sample. No obligation of course.

FREE trial set of FLEXIBAL GUY GUARDS

SET of Flexibal guy guards for 7 foot length will be sent at no cost for test. Write on your business letterhead.

S. E. OVERTON CO.

SOUTH HAVEN, MICHIGAN



EASY TO INSTALL

Packed in easy-carry carton, Flexibal guy guards take only a couple of minutes to install. They save you money.

LONG LIFE

Lower first cost, lower installation cost, *and* longer years of trouble-free service make Flexibal the guy guard for you.

the hanger flanges has been maintained. This permits replacement of existing 15-kvar units with 25-kvar sizes, or use of both sizes in same hangar, or relocation of a single terminal lead. Mass of tank above and below the hangar in the 15-kvar design is about equal; in the 25-kvar rating two-thirds below the hangar (see illustration).

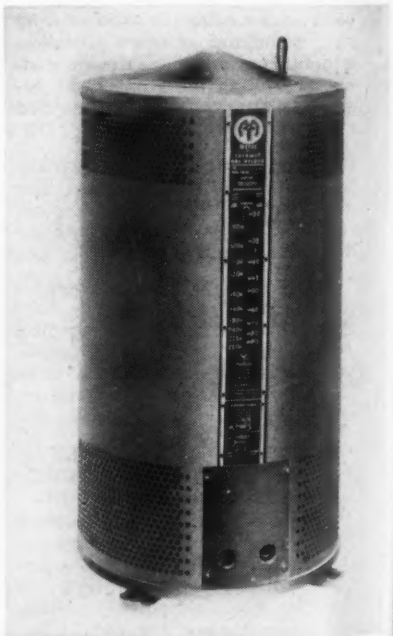
For the complete line, the capacitor tanks are fabricated of stainless steel, "Hydis" treated, and are said to require no painting. The finish is reported to be a chemical change of the surface, creates a deep blue color, improves heat radiating characteristics; and the surface provides electrical contact to the metal hangers thereby eliminating tank grounding problems. A new "Life-Time" bushing is solder-sealed to the cover of the capacitor and a parallel groove terminal connector is provided.

•

Arc Welders

A NEW GROUP of welding machines, a-c and d-c, have been announced by Metal and Thermit Corp, 120 Broadway, New York 5, N. Y.

The a-c unit, illustrated, is said to include built-in power factor corrector, wide current range and moderate open-



circuit voltage operation. Transformer type units are available in 150, 200, 300, 400 and 500-amp capacities. Electrode leads are plugged in or out by taper-type connectors and running gear for portability can be specified.

Featuring a one dial control panel, the motor-driven d-c units are available in 150, 200, 300 and 400-amp capacities at either 3600 or 1750 rpm. Engine-driven welders include 200, 300 and 400-amp sets.

TIGHT CONNECTIONS *assured by using* PALNUT TRADE MARK SELF-LOCKING NUTS

● The Railway & Industrial Engineering Co. overlooks no detail to insure years of satisfactory service from its products. An example is the use of PALNUTS to assure permanently tight nut-and-bolt assemblies on its line of fittings, switches, clamps, cutouts and other R. & I. E. equipment.

TIGHT connections are vital in the distribution and transmission of power. That's why you see PALNUTS on wood pole lines, steel transmission towers, bus fittings, connectors, switchboards, terminals, substations and other electrical equipment.

PALNUTS apply quickly on top of regular nuts, holding them to original tightness under severe vibration. No check-ups or re-tightening are required. On electrical connections, perfect conductivity is maintained. PALNUTS are available in a wide range of sizes in plain spring tempered steel; also hot-dip galvanized and silicon bronze for weather resistance.

Send details of your needs for samples. Write for literature on entire line.

THE PALNUT CO.

51 Cordier St., Irvington 11, N. J.

DOUBLE-LOCKING **PALNUTS**

Trademark Reg. U.S. Pat. Off.

no more worries for me

...now that

KOPPERS CREOSOTE

is plentiful again!

IF you need creosote for pressure-treating wood, just send an SOS to Koppers, and we'll ship your requirements. And you'll look just as happy as the man above, because you'll get the same high-quality Koppers Creosote you've always known.

When you order Koppers Creosote (or Koppers Creosote-Coal Tar Solutions), it's important to remember that you're getting products that have decades of dependable performance behind them . . . that have established enviable records as wood preservatives everywhere.

Send in your order now. And if you want to *play safe*, ask about Koppers yearly contracts that take care of your future needs.

KOPPERS

All Standard Specifications For All Types of Wood Preservation

KOPPERS COMPANY, INC.
Pittsburgh 19, Pa.

NEWS ABOUT PEOPLE

Louisville Gas & Electric Elects Vice-Presidents

Announcement has been made by the Louisville Gas & Electric Co of the election of three new vice-presidents. They are George R. Armstrong, executive vice-president; Lawrence G. Dahl, and Frank J. Pfeiffer, vice-president and secretary.

Mr Armstrong joined the Louisville utility in 1922 as a construction engineer and was appointed superintendent of construction in 1929. Since that time he has held the position of assistant general superintendent and general superintendent, in which capacity he supervised the operations and construction work of the company.

Following graduation from the University of Wisconsin in 1924, Mr Dahl

G. R. ARMSTRONG

became a member of the rate regulatory staff of the Public Service Commission of Wisconsin, and the following year joined the Public Utility Engineering & Service Corp of Chicago as a member of the rate and research staff. In 1938 he became identified with the Louisville Gas & Electric Co as manager of the rate and research department. Since that time he has been executive assistant and assistant to the president.

In 1909 Mr Pfeiffer entered the employ of the Louisville Gas Co, a predecessor company, which was consolidated with others to form the Louisville Gas & Electric Co in 1913. During his 39 years with the Louisville Gas & Electric he has held the position of paymaster, stores accountant, and assistant auditor.

L. G. DAHL

In 1930 he was elected assistant secretary and assistant treasurer, and was made secretary and assistant treasurer in 1931.

•

▶ EDWARD X. HALLENBERG has been appointed assistant director of the Westinghouse Research Laboratories. Formerly personnel manager at the Laboratories, Mr Hallenberg will serve as administrative aide to Dr J. A. Hutcheson, director of the laboratories. In addition, he will assume responsibility for all laboratory service activities. He joined Westinghouse in 1937 at the Sharon transformer division and later was made assistant to the manager of industrial relations. He entered the research laboratories as personnel manager in 1946.

▶ WILLIAM P. MCPHERSON has been appointed commercial sales manager of the Carolina Power & Light Co, Raleigh, N. C., to succeed M. H. HICKS, resigned. ROBERT H. PEARCE, sales supervisor of the Raleigh district, will succeed Mr McPherson as divisional power sales engineer.

▶ MAURICE E. SELLERS has been elected superintendent of municipal utilities at Madisonville, Ky. He succeeds DAN M. KELLY, resigned. Mr Sellers is assistant manager of the Rural Electrification Administration in the Owensboro, Ky., area.

▶ T. E. DAWSON has been elected president of the Houston County Electric Cooperative, Inc, Crockett, Tex.

Evans Made Vice-President, Kansas Gas & Electric

Gordon W. Evans, assistant to the president of the Kansas Gas & Electric Co, Wichita, for the past year, has been elected vice-president of the company.

Mr Evans had been connected with the utility field for almost 25 years. Before going to Wichita last year he was president of the Missouri Edison Co and the East Missouri Power Co, with headquarters in Louisiana, Mo.

His early experience was obtained in Oklahoma with the Public Service Co of

G. W. EVANS

Oklahoma at Tulsa and with the Oklahoma Power & Water Co at Sand Springs.

•

▶ EMORY PARDUN, lighting engineer, has been transferred from the illuminating department of the Sioux City Gas & Electric Co to the staff of C. E. Murphy, general sales manager of Sioux City's associated companies. Mr Pardun has had 15 years' experience in the lighting field. In 1939 he earned a membership in the "Forty Niner Club", an honorary organization, founded by the General Electric Lighting Research Laboratories, in which membership is awarded to lighting engineers throughout the United States who were instrumental in the installation of a fluorescent lighting job of 49-foot candles or more, which was considered an accomplishment at that time. He was also given the Gold Bomber Award by the General Electric Co in 1943 for outstanding service in increasing war plant production through

What happens to your drawings?

Is one drawing enough, or do you need copies?

Place your drawing on any one of the many Ozalid sensitized materials, feed it into the Ozalid machine, and you will have a positive (not negative) copy, dry-developed and ready to use, in a matter of seconds!

Do you change or make additions to originals?

Instead of altering or changing your original, do it on a translucent Ozalid print. You can then combine as many changed prints as you wish by putting them on transparent Ozalid film, overlaying them on a sheet of Ozalid sensitized paper, and processing!

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Ozalid papers are available in light, standard, and heavy weights. You can even make Ozaprints with reproductions on both sides of the sheet!

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Reproduce your drawings on Ozalid papers in black, blue, red or sepia on white or tinted backgrounds. Color code prints for different departments . . . color code different circuits, dissimilar lines or symbols, etc. for greater clarity.

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Make translucent Ozalid Intermediates directly from your tracings for use as "masters" in your printmaking. This saves the original . . . provides "masters" for different departments, branches, contractors, etc. (Ozalid Intermediates are actually better to print from than originals. They increase line density; can be made on new Ozalid plastic surfaces, impervious to stain and smudge.)

If you make drawings—or use them—Ozalid can save you time and money. Write today, and learn more about *how* Ozalid can tighten up lost time and money in your field.

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★ **No tie-ups when you shift from one type of print production to another. Simply choose your Ozalid material . . . and your Ozalid Streamliner exposes and dry develops it. Standard work prints are produced in 25 seconds.**

★ **Your drawings can be up to 42 inches wide, any length. Roll stock or cut sheets can be used. (Special machines accommodate 54″ wide drawings.)**

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DEPT. NO. 206

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In that SPLIT-SECOND
before the breakers opened...
do you want to know what happened?
How long did it take to trip the breaker?
What was the peak fault current?
What were the power surges like?
LET THE RS-9 AUTOMATIC OSCILLOGRAPH TELL YOU!
12 elements: voltage, current, or power
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Self-contained—up to 3 starting relays
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BIG 10-ROLL CAN of
GOLD SEAL TAPE

● Off the market during the war, this handy 5 pound can of Gold Seal Tape is back again ... the best buy for regular users. Every roll is doubly protected for factory freshness.

Whatever way you buy tape, you'll find Gold Seal always just right in "tack"; clean handling; non-raveling; non-peeling. Try it. Jenkins Bros. (Rubber Div.) 80 White Street, New York 13.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

JENKINS Gold Seal Tapes
FRICTION - RUBBER

MADE BY JENKINS BROS. ... MAKERS OF FAMOUS JENKINS VALVES

improved lighting in assembly and inspection lines. Mr Pardun is active in the Illuminating Engineering Society, having served as secretary-treasurer of the Nebraska-Iowa section for two years and as a member of the board of managers.

•

Berk Made Vice-President of Lightolier, Inc

Election of Theodore Berk as a vice-president and director of Lightolier, Inc, Jersey City, N. J., has been announced. Starting as a stock boy in the Lightolier company 26 years ago, Mr Berk has made consistent progress, serving at the time of his recent promotion as merchandise manager for the lighting fixture division. For the previous nine years, he had been assistant merchandise manager and Metropolitan sales manager of the company's lighting fixture division.

T. BERK

Mr. Berk is a member of the Illuminating Engineering Society.

•

▶ D. F. McCURRACH, assistant general manager of the Pacific Power & Light Co, Portland, since 1942, has been appointed to a new position as assistant vice-president in the rate and research department.

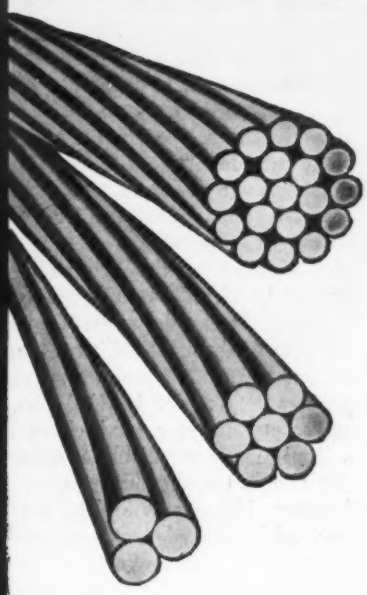
▶ HARRY BLAKEBOROUGH has resigned as superintendent of public utilities for the city of Kelowna, British Columbia. Mr Blakesborough was city engineer for 40 years and retired early this year. He was re-engaged as utilities superintendent to supervise the reconstruction of the city's electrical system.

▶ DR RALPH BOWN, research director of the Bell Telephone Laboratories, has been awarded the medal of honor of the Institute of Radio Engineers in recognition of "distinguished service rendered through substantial and important advancement in the science and art of

PAGE

Stainless Steel

STRAND



Higher

in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

Lower

in Cost per Year of Installed Life

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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

In Business for Your Safety

Stepmother

to a thousand drumsticks

Even in chicken raising, electricity can help do a better job. Controlled incubation, brooding, feed grinding . . . all mean healthier, bigger chicks and less fatalities.

Farm uses for electricity grow daily . . . and rural electrification keeps pace with the ever-growing demand.

Hemingray Power Insulators play an important part in many rural electric systems by supplying highly efficient and dependable insulation on medium-voltage pole lines.

The Technical Standards Committee of the Rural Electrification Administration has approved Owens-Illinois Insulators No. 670, No. 680 and No. 514, under the limits of AIEE Specification No. 41-1944 for use on REA lines.

No. 670 for 12,000 volt lines, No. 680 and 514 for 15,000 volt lines.

Hemingray Power Insulators are available for early shipment, in large lots or small, at most jobbers.

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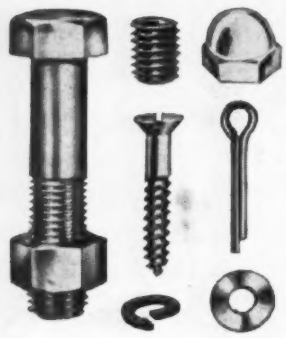
POWER INSULATORS

American Structural Products Company

MUNCIE, INDIANA

SUBSIDIARY OF OWENS-ILLINOIS GLASS COMPANY

11 ~~10~~ REASONS FOR USING HARPER EVERLASTING FASTENINGS



1 Resistance to Rust and Corrosion
2 Resistance to High Temperatures
3 Non-Magnetic
4 Non-Sparking
5 Re-Useable
6 Attractive Appearance
7 Easy to Clean
8 High Strength
9 Long Life
10 Lower Ultimate Cost
11 RESISTANCE TO FATIGUE

—Only 1 Reason for using common steel ...LOWER FIRST COST!

PROMPT SHIPMENT FROM STOCK — Bolts, Nuts, Screws, Washers, Rivets, Accessories ...
Harper maintains stocks of over 5,000 individual items in Chicago and New York . . . large quantities of each. Others being added constantly. Specials made to order from ample stocks of raw materials.

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BRANCH OFFICES: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Los Angeles, Milwaukee, Philadelphia, St. Louis, San Francisco, Seattle, Toronto (Canada).

HARPER'S 25th Anniversary

HARPER

More Efficient Lighting *with* ABolite

DUO-MOVE SYSTEM OF MAINTENANCE

QUICK REPLACEMENT — EASY TO CLEAN — SAVES TIME & LABOR

ABolite DUO-MOVE type reflectors consist of a hood with separable socket which remains permanently attached to the conduit. The lower member of socket is attached to metal collar at top of reflector neck. This permits reflector and lamp to be taken down as a unit. With the Duo-Move Changer, maintenance is so easy and quickly accomplished you can always have clean reflectors and bright, efficient lighting. DUO-MOVE and separable socket type reflectors are available in RLM standard dome, shallow dome, deep bowl and mercury vapor types. ABolite Reflectors are sold exclusively through electrical wholesalers.

Light right with

ABolite REFLECTORS PORCELAIN ON STEEL

THE JONES METAL PRODUCTS CO., West Lafayette, Ohio

radio." Dr Bown was president of the Institute in 1926, and holds many patents relative to radio and telephone communications.

•

New Appointments Made by West Penn Power

New appointments and realignment of certain departmental functions have been announced by P. H. Powers, newly-elected president of the West Penn Companies, for the Power Company organization.

No changes are planned in the power department, which is under Allen N. Cartwright, vice-president.

The rate department, R. E. Caywood, manager, will become a part of the financial department under W. H. Swinney, vice-president.

In addition to the groups now reporting to H. K. Breckenridge, vice-president, three departments will be added to his responsibilities; purchasing under D. E. Winslow, purchasing agent; safety under H. F. Webb, general safety director, and claim under A. R. Blume, general claim agent.

In the operating department, J. O. Chambers becomes operating manager. Four additional departments will be under his direction: lines under C. F. Sheakley, real estate under Ralph H. Miller; commercial under W. E. Sturm; and service under A. B. Zurick.

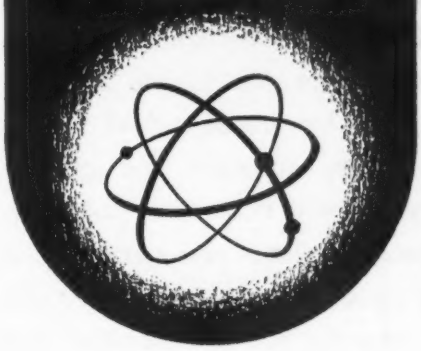
Harry Restofski has been made general sales manager in charge of the sales department. In addition to his present responsibilities, three new groups now come under his direction: industrial sales department under George E. Duerr; municipal sales department under C. V. Doherty, and the advertising department under H. S. Metcalfe.

Mr Powers' staff will include the vice-presidents; operating and general sales managers; Francis McQuillin, assistant to the president; C. L. McCormick, adviser on legal matters; G. Ernest Murrie, secretary; H. S. Metcalfe, director of public relations; and A. J. Lois, office assistant.

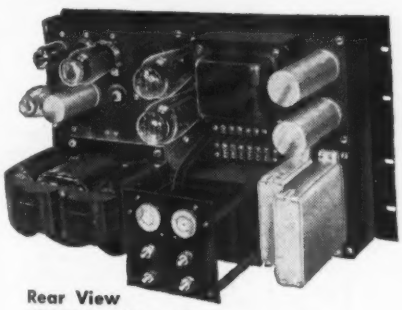
•

► Floyd E. Hudson has joined Day & Zimmermann, Inc, Philadelphia, in the capacity of assistant to the vice-president. Mr Hudson has a background of experience in the electrical engineering field and in public utility rate work which dates back to 1924. After a period with Westinghouse Electric Corp at East Pittsburgh on test and switchgear engineering, he became affiliated with various public utilities in eastern United States and Canada in an engineering capacity. His most recent connection was with the Bangor (Me.) Hydro-Electric Co as electrical engineer

QUICK AS AN ELECTRONIC WINK



That's how fast a STABILINE Automatic Voltage Regulator corrects line voltage fluctuations. Type IE (Instantaneous Electronic) has no moving parts — is completely electronic in operation. Designed to act instantaneously—with a waveform distortion not exceeding 3 percent — and to keep output voltages stable within ±0.1 of 1 percent of the preset value, regardless of line variations. For any load current change or load power factor change from lagging .5 to leading .9, the STABILINE Type IE will hold the output to within ±0.15 volts of nominal. Various models available in numerous ratings.



Rear View
STABILINE Type IE

Bulletin 547 gives you information on this and other Superior Electric voltage control equipment. Write for your copy today.

THE
SUPERIOR ELECTRIC
COMPANY
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BRISTOL, CONN.

and rate specialist. Mr Hudson's name was published in error as Hanson in ELECTRICAL WORLD, Oct 2, page 28.

OBITUARY

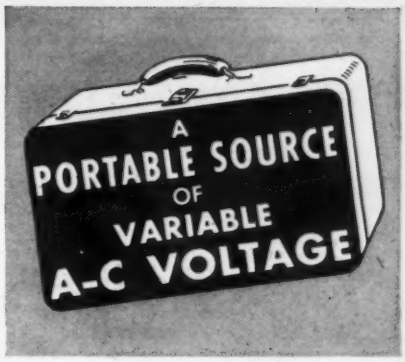
► J. FRANK KELLEY, purchasing agent of the Electric Power Board of Chattanooga, Tenn., died on Oct 20 as the result of a cerebral hemorrhage. He was 53 years old. A native of McDonald, Tenn., Mr Kelley spent his entire business life in the purchasing field. He was appointed assistant purchasing agent of the Tennessee Electric Power Co in 1923 and had become general purchasing agent when the company's properties were purchased by the Electric Power Board in 1939. He had served as president of the Chattanooga purchasing agents organization and as a director of the National Association of Purchasing Agents.

► ARNOLD E. BOWEN, research engineer at the Bell Telephone Laboratories in Holmdel, N. J., died on Oct 15 in East Stroudsburg, Pa., at the age of 47. Mr Bowen's discoveries were of importance in the development of radar in World War II. He served on the teaching staff of Yale University, his alma mater, before entering the research department of the American Telephone & Telegraph Co in 1923. He was transferred to the Bell laboratories in 1934.

► CHARLES E. BONINE, widely known consulting engineer and former associate director of the Franklin Institute, Philadelphia, died on Oct 25 at the age of 74. In the early days of his career Mr Bonine designed electrical and mechanical equipment for the Holland type of submarine. He joined the staff at Franklin Institute in 1930, directing both the construction of the building for the housing of special engineering exhibits and the arrangement of the exhibits. In 1935 he resigned from the museum to return to private consulting engineering practice. He was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and of other engineering societies.

► ALVIN G. BECKER, founder, president, and manager of the Round Valley Light & Power Co, Springerville, Ariz., died suddenly on Oct 18 at the age of 54.

► HARRY B. READ, 56, manager of Salem Electric, a cooperative serving a limited area in Salem, Ore., died Oct 9. He was one of the original organizers of Salem Electric nine or 10 years ago and had been manager since its organization.



VOLTBOX
A-C POWER SUPPLY

- *COMPACT*
- *PORTABLE*
- *HANDY*

Operation of the Superior Electric VOLTBOX is simple. Plug into 50/60 cycle single phase source, snap "ON-OFF" switch to "ON". Snap "LINE-LOAD" switch to "LOAD", rotate knob to produce continuously adjustable output voltage, from 0 to 17 per cent above line voltage. Read line voltage by snapping "LINE-LOAD" switch to "LINE".

TYPE UC1M

INPUT: 115 volts, 50/60 cycle, single phase

OUTPUT: 0-135 volts, 7.5 amperes, 1000 VA

Type UC2M available for 230 volt operation.

ALL THIS IN ONE PORTABLE PACKAGE

Cast aluminum case • POWERSTAT variable transformer • Easy-to-read voltmeter • Superior 5-Way Binding Posts • Output receptacles • "ON-OFF" switch • "LINE-LOAD" switch • Renewable fuse for overload protection • Six foot cord-plug.

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SUPERIOR ELECTRIC
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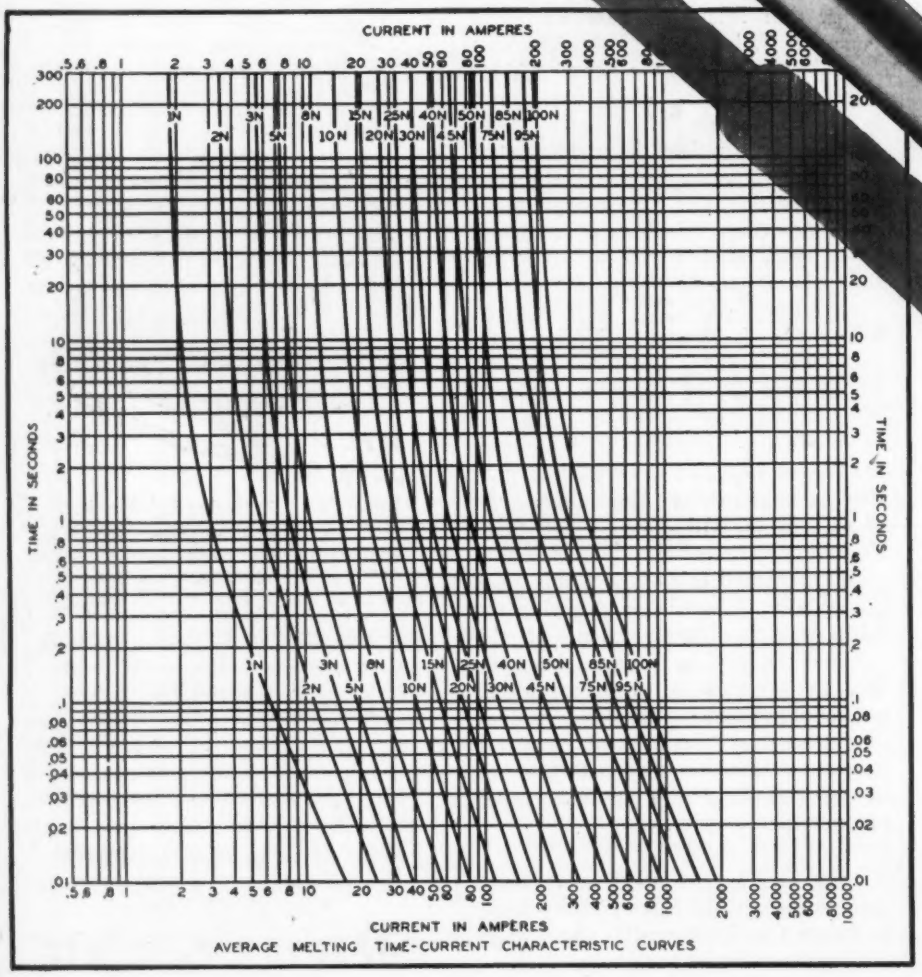
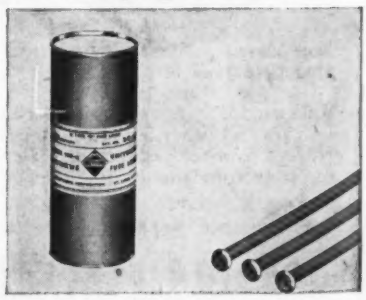
ACCURACY-UNIFORMITY AND STRENGTH IN FUSE LINKS

are essential to better fuse performance. These characteristics are designed into the SERIES 50H and 100H UNIVERSAL MATTHEWS FUSE LINKS. Using closely calibrated, high tensile strength materials for the fusible elements and assembling parts by crimping (not soldering) assures uniform accuracy and greater strength and permits closer fuse coordination accuracy. They are available in the standard ratings from 1 to 100 amperes and are manufactured in compliance with NEMA Standards — Publication 38–53.

For further information write for Bulletin 533. Large Time Current Characteristic Curves will also be furnished upon request.


CURRENT IN AMPERES
TIME IN SECONDS
1N 2N 3N 5N 8N 10N 15N 20N 25N 30N 40N 45N 50N 65N 75N 100N 95N
CURRENT IN AMPERES
AVERAGE MELTING TIME-CURRENT CHARACTERISTIC CURVES

Each Individual Fuse Link Protected by a Paper Tube and Packed 25 in Telescoping Container



W. N. MATTHEWS CORPORATION
SAINT LOUIS, U. S. A.
ENGINEERS and MANUFACTURERS SINCE 1899

MANUFACTURERS and MARKETS

Westinghouse Sales Set New Peace-Time Record

Westinghouse Electric Corp attained a new peace-time high with sales which totaled $711,275,535 for the first nine months of 1948, compared with $583,342,409 for the similar period of last year.

Net income for the first nine months this year amounted to $33.546,345, a return of 4.7% on total sales and equal to $2.45 a common share. For the similar period of 1947, net income was $34,514,886, which represented a return of 5.9% on sales, equal to $2.53 a share.

Gwilym A. Price, president, pointed out that higher wages of Westinghouse employees and higher prices on materials and services, which reflect wage increases in other industries, added more than $45,000,000 a year to the cost of manufacturing and selling Westinghouse products. Only about half of this amount can be recovered through the price increases Westinghouse has made since the third round of wage increases, he explained.

New orders received during the nine months of the current year totaled $822,729,940, compared with $744,797,608 in the similar period of 1947. Unfilled orders on last Sept 30 were $730,934,046, against $715,566,792 a year earlier.

•

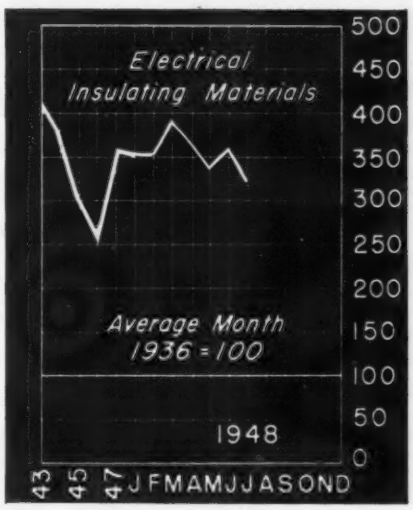
Expands Tool Production

The Bradford Machine Tool Co, Cincinnati, Ohio, has developed a new line of electric tools, which includes a combination hand polisher, grinder and drill and a 10-inch polisher. More tools are ready for introduction, J. R. Stewart, president, stated. The company converted to electric tool production in 1945.

•

Opens Milwaukee Office

Wheelco Instruments Co, Chicago, has opened a new office at 138 East Becher St, Milwaukee 7, Wis. M. A. Embertson, who was formerly connected with the company's Chicago sales office as sales engineer, is in charge of the new Wisconsin office.



Insulating Materials Sales Decreased 8% in July

Sales billed on electrical insulating materials during the month of July, 1948, dropped sharply, according to figures released by the National Electrical Manufacturers Association. The index dropped to 323 from 352 in June, a decrease of 8%.

In July, 1947, the index stood at 324, according to the report.

•

Expansion Plan Completed by Porcelain Company

The $125,000 expansion program announced last winter by Illinois Electric Porcelain Co, Macomb, Ill., has been completed. The new oil-fired tunnel kiln cost $63,500, while the balance of the expenditure was used for a plant addition and other improvements in the existing factory.

Covering a distance of 201 ft as compared with the 383-ft length of the old kiln, the continuous fire tunnel kiln is oil-fired and automatically heat-controlled. It is expected to increase the capacity of porcelain products by 50%, A. G. Benard, vice-president and general manager, stated in announcing the completion of the program.

Among the improvements reported is the installation of a new underground conveyor system to provide improved dust collection facilities. The new ceramics laboratory is a part of the expansion program.

U. S. Rubber Ups Electric Wire Prices 5 to 10%

United States Rubber Co announced increases of from 5 to 10% in prices of electrical wire and cable to offset the rising costs of labor and materials, effective Nov 1.

Prices for copper and aluminum building wire, service entrance cable, and non-metallic sheathed cable have been raised 5%, while prices for lead-encased cables have been raised 10%, C. W. Higbee, manager of the wire and cable department, said. Copper and aluminum building wire, used to wire homes and industrial buildings, represent the largest volume lines.

The increases are the direct result of raw materials costs which, in some cases, have tripled since before the war. These advances, coupled with sharply higher labor and production costs, have been too great to allow them to be fully absorbed in selling prices, Mr Higbee said.

•

Holds High Profits Create High Standard of Living

Creation of new jobs and a higher standard of living must come from the profits of American industry rather than by government financing and controls, Howard E. Blood, president of the Norge division, Borg-Warner Corp, Detroit, stated recently at Virginia Beach, Va.

Speaking at the Institute on Industrial Relations, sponsored by the National Association of Manufacturers, Mr Blood maintained that profits will be the means by which factories will be built and products invented and developed for making new jobs for America.

"What is needed is an expansion of activity that makes goods, makes jobs, and raises our standard of living," said Mr Blood. "Our best bet as a source of progress is free competitive enterprise, adequately supplied with funds for risk and profit, and sparked by an adequate willingness by all people to invest these funds. It is enterprise supported by the teamwork of all of the people."

Mr Blood told approximately 200 industrial executives attending the five-day

Silicone News

DC SILICONES

SILASTIC* INSULATED WIRE AND CABLE

Now Available for High Temperature High Voltage Applications

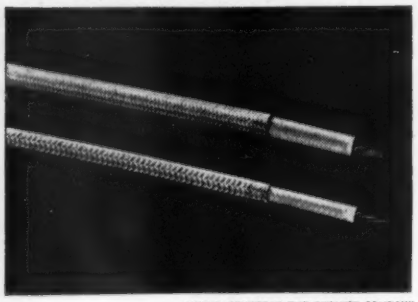


PHOTO COURTESY THE OKONITE COMPANY

Silastic is extruded over wire and cable ranging from No. 18 to 500,000 circular mils in size to provide insulation having maximum resistance to heat, ozone and weathering.*

Silastic* has been chosen to insulate the new line of heat-stable "Okotherm" wire and cable made by the Okonite Company of Passaic, N. J. Silastic* insulation maintains its high dielectric strength even after continuous long time exposure to temperatures as high as 200° C. (400° F.). Its dielectric loss factor is low compared with that of organic rubbers.

Silastic* insulation is practically unaffected by corona or ozone. A severe corona resistance test of Silastic 181 for example, was discontinued after more than 4000 hours without breakdown. The best organic rubber insulating materials break down under this same test in 50 to 150 hours.

Silastic* insulated wires and cables withstand severe outdoor weathering without deterioration because of exceptional water repellency, low moisture absorption, resistance to oxidation and flexibility at low temperatures. Serviceable operating temperatures range from —80° to +400° F.

These properties plus good resistance to a variety of chemicals and hot oil are now available to you in Silastic* insulated wire and cable. Among the many high temperature applications for Silastic* insulated wire or cable are: power plant wiring and lead wire for electric ovens, furnaces and motors.

Other applications include wiring for high intensity floodlights and street lights, and as high voltage ignition and neon sign cable. Our specificatons for Silastic* insulated wire and cable are given in pamphlet No. G 6-AB.

*TRADEMARK DOW CORNING CORPORATION

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
Atlanta • Chicago • Cleveland • Dallas
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Dow Corning
FIRST IN SILICONES

labor-management institute that a high-level of prosperity is a necessity if the United States is to fulfill its own defense needs and ECA obligations abroad.

•

EWRT Sponsors Workshop for Electrical Living

A workshop for Electrical Living built around electrical appliances and the careers they offer to women in the industry has been planned by the Electrical Women's Round Table as its 1949 Educational Program, Ruth Gaffney, chairman of the organization, has announced.

Scheduled to commence on Jan 23 and to be held every last Wednesday of the month thereafter until April 25, the workshops will be conducted from 9.30 a. m. to 5 p. m. and 7.30 p. m. to 9.30 p. m. at the General Electric Co auditorium at 570 Lexington Ave, New York.

The workshops have been designed for a three-fold purpose: (1) To enlarge the horizons of women now engaged in working with electrical goods in the fields of promotion, advertising, merchandising, and manufacturing, particularly with respect to new developments; (2) to present to women about to enter the electrical industry various types of opportunities and responsibilities in the various fields; (3) to stimulate those who are teaching home economics in colleges and homemaking in high schools and vocational schools and technical institutes.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

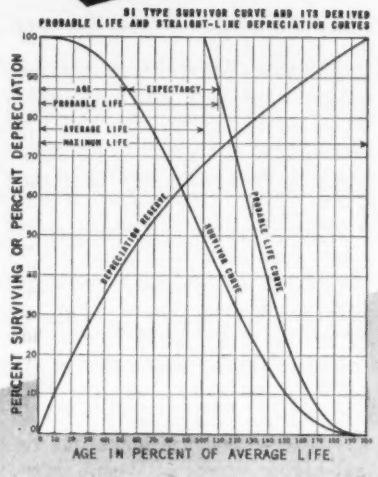
Oliver Iron & Steel Corp has appointed G. Mayne Daly as southern sales manager of the pole line hardware division. Formerly northeastern district manager with headquarters in New York, Mr Daly will be in charge of Oliver warehousing facilities in Birmingham, Ala. He will also have sales supervision over eight states in the southeastern section.

Great Western Fuse Co, Pittsburgh, Pa., has appointed Jos. L. Barnard Associates, Inc, Minneapolis, Minn., as sales representatives in Minneapolis, North Dakota and western Wisconsin.

C. P. Clare & Co, Chicago, has appointed the E. L. Berman Co, 1355 Market St, San Francisco 3, Calif., as representative in northern California and Nevada.

Trumbull Electric Manufacturing Co has appointed A. T. Allison as district manager of its Southeast sales district, with offices at 700 West 5th St, Charlotte, N. C.

Here's help in measuring depreciation the modern way!



The "Survivor Curve" is one of the modern tools used to measure depreciation of plant for tax purposes. Just as a "Mortality Curve" used by actuaries measures man's life expectancy as a basis for life insurance rates, this curve measures the life expectancy of your plant as a basis for depreciation estimates.

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RECENT RATE CHANGES

Boston Edison Co has announced detailed rate reductions of approximately $689,000, affecting 356,000 domestic customers from Dec 1. Every such home using 12 or more kilowatt-hours per month will benefit. This is the company's second postwar cut in residential rates. The new rate is 72 cents total for the first 12 kwhr per month; 5 cents each for the next 60; and 3 cents each for all over 72. Existing fuel charges applying to residential rates are continued. Residential usage now averages 100 kwhr per domestic customer per year. Excluding the fuel charge, the new rate reduction will range between 8 and 24 cents per month per residential customer. On a consumption of 20 kwhr per month, the price will be reduced from $1.20 to $1.12. For the 100-kwhr-per-month user, the price will drop from $4.80 to $4.56. The new residential rate is the lowest in the company's history. It was filed with the Massachusetts Department of Public Utilities, following conferences with the board, and is voluntary on the company's part. President J. V. Toner stated that electricity constitutes the "shining exception to the rule of high prices," and that the reduction appears within the company's capacity to absorb unless costs of all kinds should rise substantially above present levels or there should be a drastic and precipitate shrinkage in gross revenues. Increased operating efficiency and growth of load are major factors in the cut.

Pennsylvania Public Utility Commission has postponed from Nov 15, 1948, to Jan 1, 1949, the effective date of its order fixing temporary rates for Pennsylvania Water & Power Co and Safe Harbor Water Power Corp. PUC also postponed the tariff filing deadline from Nov 1 to Dec 15. Consolidated Gas, Electric Light & Power Co of Baltimore, an equal shareholder with PW&P of Safe Harbor's stock, filed a complaint in U. S. Middle District Court at Scranton, Pa., seeking a preliminary injunction restraining the PUC from enforcing its Sept 27, 1948, order, fixing temporary rates reducing revenue of the two companies $1,170,000 annually.

Scranton (Pa.) Electric Co has filed with the Pennsylvania Public Utility Commission supplements to its electric and steam heating service tariffs, that became effective Nov 1, which would increase rates by establishment of fuel adjustment clauses in both. The fuel adjustment clause, based on increases or decreases in the cost of coal used by the utility, would increase electric power rates for 213 large users an estimated $239,419 annually, and increase rates for all of its 1,032 Scranton steam heating service customers an estimated $72,695 annually. Under the fuel clause in the electric service tariff, applying on monthly use in excess of 10,000 kwhr, the charge for energy would be increased or decreased 0.00157 cents per kwhr for each whole 0.1 cent increase above 15 cents per million Btu in the average cost of fuel (on hand and delivered at the company's Stanton and suburban plants) used during the second calendar month preceding the billing month.

New England Electric System is planning a reduction in rates to domestic customers, totaling $700,000.

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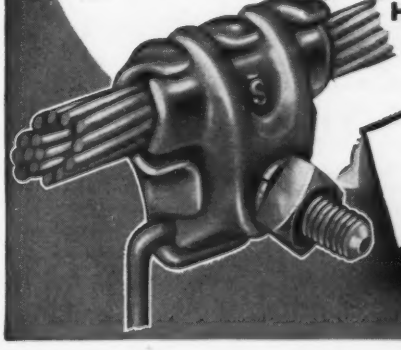

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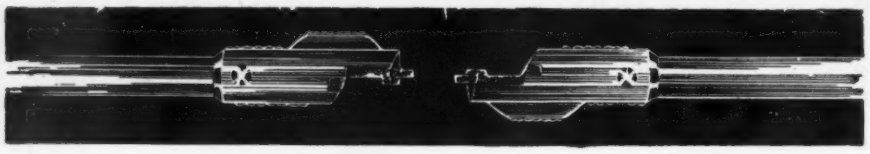

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona — Trico Electric Co-operative, Tucson, generating facilities incl. six 48 kw. generating units, two 300 kw. generating units, and five 1000 kw. dual fuel units, Pima Co. **$902,000.**

Arkansas—Woodruff Electric Co-operative Corp., Augusta, 596 mi. rural distr. lines, sys. imprvs., incl. 36 mi. tie line and completion previously approved constr., Woodruff Co. **$1,265,000.**

California—Surprise Valley Electrification Corp., Alturas, 99 mi. rural distr. line, sys. imprvs. incl. 20 mi. transmission line, headquarters facilities, 2-way radio communciation sys., completion previously approved constr., Modoc Co., **$740,000.**

Calif., Muroc—Dpt. Air Force, Wash. 25, D. C., rocket test facilities, control tower and all-altitude speed course, at Muroc Air Force Base, **$2,878,000.**

Calif., Sacramento—Sacramento Municipal Utility Dist., 59 and R Sts., exten. electric facilities, **$1,400,000.**

Fla., Jacksonville—City, furnishing installing automatic controls and instruments. Plans deposit $5; warehouse. Plans deposit $5; materials and equipment, completing 66 KV substation. Plans deposit $3, both for Electric Power Plant 2, South Jacksonville, Reynolds Smith & Hill, 227 Park St., archts. and engrs.

Georgia — Rayle Electric Membership Corp., Washington, 497 mi. rural distr. line, sys. imprvs., incl. 29 mi. tie lines, Wilkes Co. **$840,000.**

Georgia — Sumter Electric Membership Corp., Americus, 635 mi. rural distr. line, sys. imprvs., 34 mi. tie line and headquarters facilities, Sumter Co. **$1,200,000.**

Ia., Monticello—Iowa Electric Light & Power Co., Cedar Rapids, power plant and generating equip. **$105,000.**

Kan., Ft. Leavenworth — Dpt. Army, Wash., 25, D. C., power substation **$190,400**; reproduction bldg., **$971,100.**

Kentucky—Clark Rural Electric Co-operative Corp., Winchester, 210 mi. rural distr. lines, sys. imprvs. two-way radio communcation sys., Clark Co. **$533,000.**

La., Haynesville—Haynesville Electric Refrigeration Co-operative, Haynesville, food processing and locker plant, Plans deposit $25. Southwest Engineers, 510 Transit Tower, San Antonio, Tex., archts.

Minnesota—Minnesota Valley Co-operative Light & Power Assn., Montevideo, 319 mi. rural distr. line, headquarters facilities, Chippewa Co. **$575,000.**

Missouri—Southwest Electric Co-operative, Bolivar, 243 mi. rural distr. line, sys. imprvs., two-way radio communication sys., Polk Co. **$700,000.**

Montana — Yellowstone Valley Electric Co-operative, Huntley, 25 mi. rural distr. lines, sys. imprvs., two-way radio communication sys., headquarters, Yellowstone Co. **$145,000.**

Neb., Grand Island—City, addnl. imprvs. power plant incl. power piping, insulating, stack, ducts and breeching, painting, power wiring. $230,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., engrs.

Neb., Ord—City, Rex Jewett, clk., power imprvs., incl. combustion engine generating unit, draft cooling tower, and building changes. $150,000. Lutz & May, Finance Bldg., Kansas City, Mo., engrs.

N. M., Corona—Central New Mexico Electric Co-operative, Corona, piping, misc. mechanical equip. for electric generating plant. Plans deposit $5. Beavers & Lodal, 1408 Transit Tower, San Antonio 5, Tex., engrs.

North Dakota—McKenzie Electric Co-operative, Watford City, 808 mi. rural distr. lines, 39 mi. transmission line, completing previously approved constr. McKenzie Co. **$1,375,000.**

Pennsylvania—Warren Electric Co-operative, Youngsville, 75 mi. rural distr. lines, sys. imprvs. incl. 13 mi. new tie lines, headquarters facilities, Warren Co. **$250,000.**

Industry's "SHORT-Stop"
EC&M Valimitor Starter

UNLIMITED PROTECTION AT ONE COST

High voltage motor circuits deserve good protection against short circuit damage.

In the past, it has been common practice to calculate the protection needed by determining the maximum fault that can occur, based on the available KVA existing at the time the fault analysis is made.

Today, EC&M VALIMITOR Motor Starters are available. They are designed to safely interrupt a faulted motor circuit from a bus of *any* capacity. There's no further need for system analysis—no chance that such calculations will be out-moded by future growth in your own backyard, in the neighborhood or at the power source.

EC&M VALIMITOR Starters cost approximately the same as starters equipped with auxiliary devices of high interrupting capacity, but they give unlimited protection at *one* cost. There's nothing to replace when a fault occurs.

Simply send us your motor nameplate date for an "all-time" solution with VALIMITOR Starters.

Switch to EC&M VALIMITOR Starters for *all* these features

1. SHORT CIRCUIT Protection regardless of available KVA
2. OVERLOAD Protection
3. LOW VOLTAGE Protection
4. CUSHIONED STARTING — the full voltage starter may be satisfactory in many cases, saving the added cost of the more expensive reduced-voltage type of starter.
5. NO REPLACEMENTS to restart, after a fault.

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Squirrel-cage, Synchronous or Wound-rotor Motors.		
2300 volts		4600 volts
600 HP	60 cycles	600 HP
300 HP	25 cycles	250 HP

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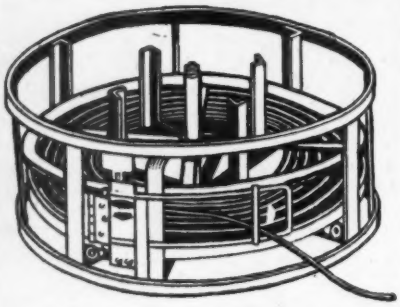

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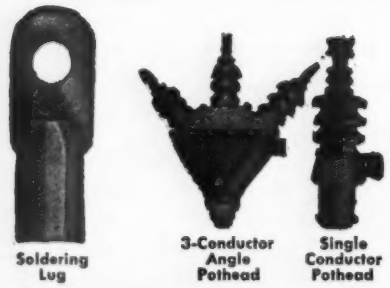

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Tennessee—U. S. Eng., 303 U. S. Courthouse, Nashville, Zone 1, furnishing, del. one 1,000 kva. water wheel generator for station service unit at Center Hill Hydroelectric Power Plant, Serial No. Eng-40-058-49-10.

Tennessee—Chickasaw Electric Co-operative, Somerville, 94 mi. rural distr. lines, sys. imprvs. incl. 16 mi. new tie lines, headquarters facilities, 2-way radio communication sys. completing previously approved constr., Fayette Co. **$470,000.**

Vermont—Vermont Electric Co-operative, Johnson, 103 mi. rural distr. lines, sys. imprvs. incl. 18 mi. new tie lines, Orleans Co. **$305,000.**

Low Bidders & Contracts Awarded

Arizona-California-Nevada — Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., furnishing, del. two 168-in. butterfly valves for Units A-3 and A-4, incl. 2 upstream flanges for turbine-inlet pipes, Hoover Power Plant, Boulder Canyon Proj., Spec. 2364, from Hardie-Tynes Mfg. Co., 800 N. 28 St., Birmingham, Ala., **$493,300.**

Mass., Amherst — Commonwealth of Massachusetts, University of Massachusetts, R. D. Hawley, treas., Oct. 14, electrical distr. sys. P E 2, Contr. 2, from Collins Electric, 211 Worthington St., Springfield, **$99,905.** Hollis French, 210 South St., Boston, engr.

Pa., Phila.—Surpass Leather Co., 9 and Westmoreland Sts., power plant alterations, modernization, separate contracts. **$200,000.** Ebasco Services, Inc., 2 Rector St., New York, N. Y., engrs.

Pa., Phila.—Dpt. P. Wks., City Hall Annex, outdoor substation International Airport, from Electric & Telephone Line Constr. Co., 6100 N. 20 St., **$82,864.** A. Zane Hoffman, c/o owner, ch. engr.

Tex., Baytown—United States Rubber Reserve, Baytown (General Tire & Rubber Co., Baytown, operators), expans. and remodeling plant to incl. mfg. of cold process rubber, incl. large refrigeration plants, sub-contracts. Approx. **$740,000.**

Tex., Beaumont—United States Rubber Reserve, c/o B. F. Goodrich Rubber Co. (operators), Beaumont, rubber plant expan. to manufacture cold rubber, incl. large refrigeration, sub-contracts. Approx. **$625,000.**

Tex., Port Neches—United States Rubber Reserve, Port Neches (B. F. Goodrich Rubber Co., operators, Beaumont), remodeling, constructing rubber plant providing manufacture of cold process rubber, incl. refrigeration plant. Sub-contracts. Approx. **$900,000.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Lincoln—Abraham Lincoln Memorial Hospital, Lincoln, plans by Deal & Deal, Lincoln, 100-bed hospital, **$1,250,000.**

N. C., Raleigh—N. C. State College, J. H. Harrelson, chancellor, 1 m. cu. ft. agronomy bldg. in Trailwood Housing area. **$1,000,000.** Northrup & O'Brien, 602 Reynolds Bldg., Winston-Salem, consult. engrs.

O., Dayton-Fairfield—Dpt. Air Force, Wash. 25, D. C., rotary wing test facilities, **$506,000**; armament laboratory and firing test facilities, **$1,051,000**; auxiliary bldg. for wind tunnel, **$330,000**, Wright-Patterson Air Force Base.

Pa., Phila.—Paper Manufacturers Co., 5 and Willow Sts. mfg. plant and offices, Bustleton Ave. near Fulmer St. **$1,500,000.**

Pa., Pittsburgh—Marlin Arms, Inc., 250 Magee Bldg., plans by Phillip Friedman, 121 S. Negley Ave., 6 story, bsmnt., steel apartment, Centre Ave. **$2,000,000.**

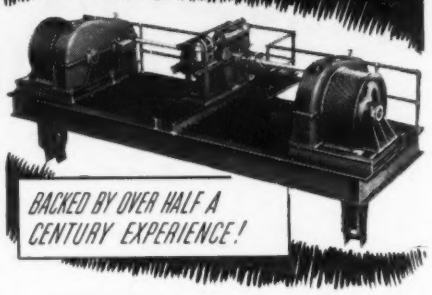
S. C., Charleston—Cooper River Dist. Hospital Comn., North Charleston, 85 bed hospital. **$1,000,000.**

Low Bidders & Contracts Awarded

La., Opelousas—Humble Oil & Refinery Co., 1216 Main St., Houston, Tex., refinery, near here, to Hudson Constr. & Eng. Co., 2711 Danville St., Houston, Tex., Approx. **$4,000,000.**

Md., Baltimore—Mayor & City Council, City Hall, terminal and service bldgs. at Friendship International Airport, Contr. 9, to Consolidated Eng. Co., Inc., 20 E. Franklin St., **$3,724,000.**

WHEN YOU PLAN POWER DAM PROJECTS ASK US ABOUT GATES & GATE HOISTS



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We also build gate hoists entirely from your plans and specifications, if desired. In planning gates or gate hoists it is suggested you communicate with us before your plans for the project as a whole are completed . . . it will save expense and much preparation time.

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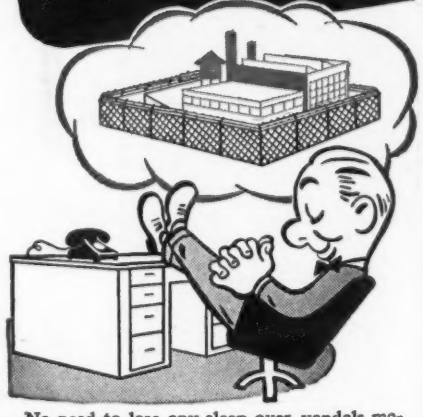

No need to lose any sleep over vandals molesting your industrial property when it's surrounded by a Stewart Chain Link Wire Fence. fence framework makes it the heaviest and The All Beam construction of the Stewart strongest chain link wire fence manufactured. A Stewart Fence will give you the utmost in protection, and many years of dependable, low cost service. Write for Catalog No. 83.

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EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Turbo-Generator Design

(*Continued from page 87*)

tors was officially adopted for trial. It is now appropriate to review the progress in building these units, and the degree of acceptance of the program by electric utilities.

The accompanying table shows the number AIEE-ASME preferred standard ratings built or on order from Westinghouse alone:—

Kw Rating	Number	Total Kw Capacity
11,500	1	11,500
15,000	0	.....
20,000	3	60,000
30,000	23	690,000
40,000	10	400,000
60,000	19	1,140,000
Total	56	2,301,500

The general situation associated with the production of the new standard units justifies the following observations:

1. All standard ratings are available except the 15,000-kw. unit.

2. Purchaser acceptance has been wide. The number and total kva of units in the preceding table represents 48% all Westinghouse turbo-generator business for ratings 10,000 kw and above.

3. In 1948 and thereafter, orders for new units are expected to be almost exclusively "standard" within the range of ratings. They are expected to represent more than 50% of the current turbo-generator business of all manufacturers in that period.

4. Under standardization manufacturers can furnish customer-approval drawings when negotiation proposals are presented. Immediately after purchase both the manufacturer and the purchaser can order materials for manufacturing and construction materials. The purchaser is thus assured a better product at reduced cost with shorter deliveries.

Comments and suggestions from both purchaser and manufacturer groups has led the existing AIEE committee to consider the following items:

a) Review of the 15,000-kw unit to decide whether it should be hydrogen cooled and if it should have the same characteristics as the four larger ratings.

b) Review of the Standard Specification Data for Generators for major additions or changes on large 3,600-rpm condensing steam turbines.

c) Consider standardizing 80,000- and 90,000-kw, 3,600-rpm hydrogen-cooled units now being purchased.

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YOUR product assembly will be quicker and easier if you use top-quality Dieflex products. Every one has smooth inside bore that makes it easy to use. It slips over bent wire, around corners, and into crowded places quickly because wire ends won't catch on the smooth inside surfaces.

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A subsidiary of the Union Metal Manufacturing Co.

LETTERS TO THE EDITOR

Pole Treatment

To the Editor of ELECTRICAL WORLD:

Your editorial, *Pole Treatment, But Which One?*, in the issue of September 25, 1948, struck a responsive note with us. The purchases of our borrowers constitute a substantial percentage of the treated poles used in the United States, and we are glad to see your interest in evaluating the various new preservatives now on the market to the point where they may be listed in preferential order.

However, there are difficulties. Coal tar creosote has been generally accepted as the most dependable treatment. There are newer preservatives available but service records on them are often meager, sketchy, or incomplete. While our use of the various alternate preservatives, petroleum fortified with 5% pentachlorophenol, 50-50 coal-tar creosote-petroleum fortified with 5% pentachlorophenol, 50-50 coal-tar creosote and oil-tar creosote, 50-50 coal-tar creosote and wood-tar creosote, oil-tar creosote fortified with 2% pentachlorophenol is based on the technical advice of men who are considered the best authorities on the preservative treatment of wood, there is no substitute for actual in-line service records.

The results of accelerated service tests are considered by wood technologists to be fairly indicative of what may be expected of any given preservative and are frequently used in making appraisals of new-comers to the field. Through these accelerated service tests it is being discovered that certain combinations of preservatives may prove to be better than when used separately. For instance, a 50-50 solution of coal-tar creosote and petroleum fortified with pentachlorophenol may surpass anything yet used. But, as we have said before, such findings must be substantiated by actual in-line service records. This means years of waiting.

Through necessity during the war when coal-tar creosote was in short supply, we approved the use of other wood preservatives. It is reasonable to assume that they are not all equal, and that when the records are all in there will be differences in service life. It is only then that we will know their relative value in terms of performance. At the same time, however, there is much that can be done now toward evaluating these newer preservatives.

There are different methods of using all preservatives-pressure, full length non-pressure, and butt treatment. These, too, need evaluation in terms of pole

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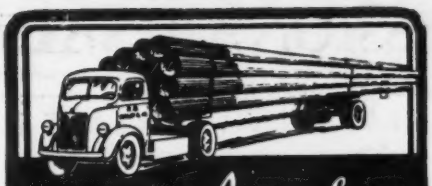
Standard Treatments

To the Editor of ELECTRICAL WORLD:

We noted in the September 25 issue of ELECTRICAL WORLD, on page 76, the editorial, *Pole Treatment, But Which One?* This is a very good article about poles themselves, but so far as treatment is concerned, the American Wood-Preservers' Association, one of whose objects is "the standardization of specifications for wood preservatives and for their introduction into the materials to be preserved," has standard specifications for various pole species—No. T1 and T4. No one, of course, can question the great durability of a pressure creosoted pole of any species. There has been an unprecedented demand for treated poles for a few years, and in 1946, for example, and to some extent earlier, there was a shortage of creosote, but today there is plenty of creosote for all needs.

P. R. Hicks
Secretary-Manager
Service Bureau
American Wood-Preservers' Assoc
Chicago 2, Ill.



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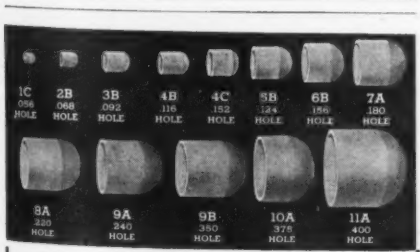

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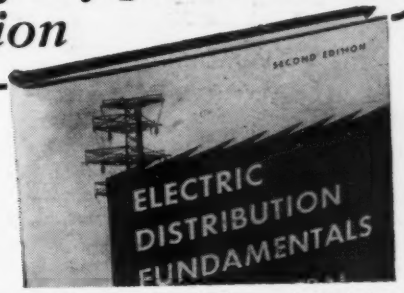

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